

Fishery Data Series No. 07-26

Abundance, Age, Sex and Size Statistics for Pacific Herring in the Togiak District of Bristol Bay, 2006

by

Chuck Brazil

May 2007

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



FISHERY DATA SERIES NO. 07-26

**ABUNDANCE, AGE, SEX AND SIZE STATISTICS FOR PACIFIC
HERRING IN THE TOGIAK DISTRICT OF BRISTOL BAY, 2006**

by

Chuck Brazil

Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

May 2007

The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: <http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm> This publication has undergone editorial and peer review.

Chuck Brazil

*Alaska Department of Fish and Game, Division of Commercial Fisheries,
333 Raspberry Road, Anchorage, Alaska 99518, USA*

This document should be cited as:

Brazil, C. E. 2007. Abundance, age, sex and size statistics for Pacific herring in the Togiak District of Bristol Bay, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 07-26, Anchorage.

The Alaska Department of Fish and Game (ADF&G) administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act (ADA) of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility please write:

ADF&G ADA Coordinator, P.O. Box 115526, Juneau AK 99811-5526

U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington VA 22203

Office of Equal Opportunity, U.S. Department of the Interior, Washington DC 20240

The department's ADA Coordinator can be reached via phone at the following numbers:

(VOICE) 907-465-6077, (Statewide Telecommunication Device for the Deaf) 1-800-478-3648, (Juneau TDD) 907-465-3646, or (FAX) 907-465-6078

For information on alternative formats and questions on this publication, please contact:

ADF&G, Sport Fish Division, Research and Technical Services, 333 Raspberry Road, Anchorage AK 99518 (907)267-2375.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	ii
LIST OF FIGURES.....	ii
LIST OF APPENDICES.....	ii
ABSTRACT.....	1
INTRODUCTION.....	1
OBJECTIVES.....	2
METHODS.....	3
Study Area.....	3
Age, Size and Sex Data.....	3
Data Collection.....	3
Sample Sizes.....	3
Age, Weight and Length Data.....	4
Commercial Harvest.....	4
Biomass Estimation.....	4
RESULTS.....	6
Biomass Estimate.....	6
Commercial Harvest.....	6
Purse Seine.....	6
Gillnet.....	7
Spawn on Kelp.....	7
Exploitation Rate.....	7
Age, Size and Sex Composition.....	7
Commercial Harvest.....	7
Purse Seine.....	7
Gillnet.....	8
Test Fishing.....	8
Age Composition of Population.....	9
DISCUSSION.....	10
ACKNOWLEDGEMENTS.....	12
REFERENCES CITED.....	12
TABLES AND FIGURES.....	15
APPENDIX A.....	35
APPENDIX B.....	41
APPENDIX C.....	67

LIST OF TABLES

Table	Page
1. Historical total run biomass and commercial harvest (tons) of Pacific herring returning to the Togiak District, Bristol Bay, 1968–2006.....	16
2. Aerial survey estimates (tons) of herring by index area, Togiak District, 2006.....	18
3. Commercial herring harvest (tons) by fishing section, gear type, Togiak District, Bristol Bay, 2006.....	19
4. Harvest, inseason biomass, total run biomass, and escapement by age from the herring sac roe fishery, Togiak District, 2006.....	21
5. Mean length (mm), weight (g), and standard deviation by age for herring of the commercial harvest by gear type, Togiak District, 2006.....	24
6. Number of samples collected by gear type, Togiak District, 2006.....	25
7. Sac roe herring industry participation, fishing effort and harvest, Togiak District 1986–2006.....	26
8. Aerial survey estimates of herring spawn deposition, Togiak District 1986–2006.....	27

LIST OF FIGURES

Figure	Page
1. Map of southeastern Bering Sea.....	28
2. Map of Togiak Herring District, Bristol Bay.....	29
3. Commercial harvest distribution by fishing section, Togiak District 2006.....	30
4. Commercial purse seine harvest distribution by fishing section, Togiak District 2006.....	30
5. Age composition of the total herring harvest, Togiak District, 2006.....	31
6. Percent age composition of the commercial harvest by gear type for weight (top) and for numbers of fish (bottom), Togiak District, 2006.....	32
7. Age composition of herring samples collected with non-selective gear used to estimate the inseason peak biomass (13 May) and postseason peak biomass (26 May), 2006.....	33
8. Historic age composition of the purse seine harvest, gillnet harvest and total run, Togiak District, Bristol Bay, 1977–2006.....	34

LIST OF APPENDICES

Appendix	Page
A1. Estimated age composition of the commercial purse seine harvest, by date and fishing section, Togiak District, 2006.....	36
A2. Estimated age composition of the commercial gillnet harvest, by date and fishing section, Togiak District, 2006.....	38
B1. Age, sex and size composition of Pacific herring caught by commercial purse seine, Hagemeister Section, 12 May–18 May 2006.....	42
B2. Age, sex and size composition of Pacific herring caught by commercial purse seine, Nunavachack Section, 12 May–19 May 2006.....	45
B3. Age, sex and size composition of Pacific herring caught by commercial purse seine, Togiak Section, 12 May–18 May 2006.....	47
B4. Age, sex and size composition of Pacific herring caught by commercial purse seine, Hagemeister, Nunavachak, and Togiak Sections, 12 May–19 May 2006.....	49
B5. Age, sex and size composition of Pacific herring caught by commercial gillnet, Kulukak Section, 13 May–17 May 2006.....	52
B6. Age, sex and size composition of Pacific herring caught by commercial gillnet, Nunavachak Section, 14 May 2006.....	54
B7. Age, sex and size composition of Pacific herring caught by commercial gillnet, Kulukak and Nunavachak Sections, 13 May–17 May 2006.....	55
B8. Age, sex and size composition of Pacific herring caught by test purse seine, Hagemeister Section, 10 May 2006.....	57

LIST OF APPENDICES (Continued)

Appendix	Page
B9. Age, sex and size composition of Pacific herring caught by test purse seine, Kulukak Section, 11 May 2006.....	58
B10. Age, sex and size composition of Pacific herring caught by test purse seine, Nunavachak Section, 9 May–10 May 2006.	59
B11. Age, sex and size composition of Pacific herring caught by test purse seine, Togiak Section, 11 May 2006.....	60
B12. Age, sex and size composition of Pacific herring caught by test purse seine, Hagemeister, Kulukak, Nunavachak, and Togiak Sections, 9 May–11 May 2006.	61
B13. Age, sex and size composition of Pacific herring caught by test fishing and purse seine, Hagemeister, Kulukak, Nunavachak, and Togiak Sections, 9 May–15 May 2006.	63
C1. 2006 Togiak Herring Forecast.....	68

ABSTRACT

The Pacific herring *Clupea pallasii* total run in the Togiak District of Bristol Bay was monitored for abundance/biomass and sampled for age, size, and sex composition in 2006. Biomass was estimated from aerial surveys with chartered aircraft. Commercial harvest was determined from fish tickets. Samples were collected from commercial purse seine and gillnet harvests. During closed fishing periods, herring samples were obtained from test fish purse seine catches made by volunteers from the commercial fleet. The estimated 2006 total run biomass was 176,288 short tons. Total commercial harvest was 23,953 tons; 16,821 tons were harvested by the purse seine fishery and 7,132 tons by the gillnet fishery. Total exploitation rate was estimated to be 14.1%. A total of 5,718 herring were sampled for age, sex, length, weight and sexual maturity information from 9 May–19 May. Herring ages varied from 3 to 18 years with both purse seine and gillnet samples predominately age-8 and -9. Mean length and weight from the purse seine fishery samples were 294 mm and 386 grams, while fish sampled from the gillnet fishery averaged 302 mm and 408 grams.

Key words: Pacific herring, *Clupea pallasii*, sac roe, abundance, spawning biomass, commercial herring fishery, Bristol Bay, Togiak District, age, length, weight, sex.

INTRODUCTION

Pacific herring (*Clupea pallasii*) are harvested in several spawning locations along the eastern Bering Sea coast from Norton Sound south to Port Moller (Figure 1). The Togiak District of Bristol Bay supports the largest discrete spawning biomass of Pacific herring in Alaskan waters. Biomass estimates based on aerial surveys have been conducted since 1978. Biomass peaked at 239,022 tons¹ (216,839 tonnes²) in 1979 and has averaged 135,082 tons (122,546 tonnes) from 1996 through 2005 (Table 1).

Herring spawn within the Togiak District from late April through May. After spawning, herring leave the fishing district and migrate south in a clockwise direction along the Alaska Peninsula to feeding areas near Unalaska Island. In August and September, these fish move to over-wintering grounds near the Pribilof Islands (Funk 1990; Rumyantsev and Darda 1970; Shaboneev 1965; Wespestad and Barton 1981; Figure 1).

The largest commercial fishery for herring that spawn in the Togiak District occurs during their inshore spawning period. The most valuable product from this harvest is the ripened ovaries, or egg skeins, referred to as sac roe. This product is primarily marketed in Japan. Commercial harvest of herring for sac roe was first documented in the Togiak District in 1968. Passage of the Fisheries Conservation and Management Act in 1976 and the resulting inability of Japanese fishers to harvest sac roe from U.S. waters prompted increased interest in the Togiak fishery by U.S. fishers. The 20-year mean sac roe harvest is presently 19,941 tons (18,091 tonnes). The greatest harvest of 30,315 tons (27,502 tonnes) occurred during the 1994 season (Table 1).

Herring spawn, deposited on brown algae *Fucus spp.* (rockweed), is also harvested within the Togiak District. This wild spawn-on-kelp product is harvested either by hand or by rake. The harvest, documented since 1967, has been intermittent in recent years because of low demand

¹ The Alaska Board of Fisheries requires that inseason catch and aerial survey biomass estimates be calculated and reported in short tons. The English short ton = 2,000 lb or 907.2 kg.

² The metric tonne = 1,000 kg or 2,205 lbs: The conversion is tonnes (t) = tons/1.1023

with no fishery occurring during the 1997, 1998, 2000, 2001, and 2004–2006 seasons. The 20-year mean spawn-on-kelp harvest has averaged 184 tons (167 tonnes; Table 1).

During their post spawning migration, herring that spawn in Togiak District are susceptible to other fisheries. A directed food and bait fishery occurs during the mid-to-late summer months in the Unalaska Island area. Harvests were first documented on these feeding herring in 1929. Harvests reached a maximum of 3,006 tons (2,727 tonnes) in 1932. The fishery declined and ended completely by 1938 because of poor market demand, but was renewed in 1981. The annual food and bait harvest since 1986 has averaged 2,032 tons (1,844 tonnes; Table 1).

Incidental harvest of Togiak herring occurs as bycatch in fisheries targeting groundfish in the southeastern Bering Sea. Foreign vessels first exploited these groundfish fisheries but domestic fishers have recently dominated. These fisheries often occur along the migratory route of feeding herring (Funk 1990; Rowell et al. 1991). The additional harvest upon a fully exploited herring population has been a concern brought before the North Pacific Fishery Management Council and the Alaska Board of Fisheries by western Alaskan fishermen.

Togiak herring have been managed as a single spawning population distinct from other populations in the Bering Sea. A maximum regulatory exploitation rate of 20% of the spawning biomass has been established in the Bristol Bay Herring Management Plan, 5 AAC 27.865. This plan provides an allocation of 1,500 tons (1,361 tonnes) to the wild spawn-on-kelp fishery and 7% of the remaining harvest for the Dutch Harbor food and bait fishery. The remainder of the harvestable surplus is reserved for the sac roe fishery with 30% allocated to the gillnet fishery and 70% to the purse seine fishery.

Stock assessment studies of the Togiak herring population began in 1976 and have continued annually since 1978 (Brazil 2007; Fried et al. 1982a, 1982b, 1983a, 1983b, and 1984; Lebida 1987; Lebida et al. 1985a, 1985b; Lebida and Sandone 1990; McBride and Whitmore 1981; McBride et al. 1981; Rowell 1995, 2002a, 2002b; Rowell et al. 1991; Sandone and Brannian 1988; West 2002; West et al. 2003; Schwanke 2003).

OBJECTIVES

Specific objectives for the Togiak herring run assessment project were to:

- 1) Estimate total run biomass and spawning escapement of herring in the Togiak District based on aerial surveys;
- 2) Determine the commercial harvest;
- 3) Estimate age, size (weight and length) and sex composition, of herring harvested in the commercial harvest;
- 4) Estimate age class contribution to the total run biomass and commercial harvest; and
- 5) Estimate the inseason and postseason exploitation rate of herring in the Togiak District.

METHODS

STUDY AREA

The Togiak District consists of all state waters between the longitude of the tip of Cape Constantine and the longitude of the tip of Cape Newenham, a linear distance of approximately 193 km (Figure 2). Because of its large size, the Togiak Fishing District is divided into six management sections: Kulukak, Nunavachak, Togiak, Hagemeister, Pyrite Point and Cape Newenham.

A wide intertidal zone and several shallow bays characterize the shoreline. Diurnal tidal range may reach 4.6 m (Selkregg 1976). The primary marine vegetation in the Togiak District consists of ribbon kelp *Laminaria spp*, rockweed *Fucus spp*, and eelgrass *Zostera spp*. Herring have spawned throughout the fishing district, particularly in areas where eelgrass and rockweed have been present. Rockweed is the most visible species of aquatic vegetation because it grows on cobble substrate in intertidal areas and upon rocky outcroppings.

AGE, SIZE AND SEX DATA

Data Collection

Pacific herring were collected from management sections within the fishing district during fishery openings and closures. Herring were sampled for each gear type and fishing section at the close of each commercial fishing period from tenders or individual fishing vessels. Attempts were made to collect samples from several vessels to ensure samples were collected from multiple schools of herring. During closed fishing periods, volunteer commercial fishers made test purse seine sets to capture herring for sampling roe content. Samples were also collected for age, sex and size information from these sets. Purse seine gear whether commercial or test fish was considered non-selective gear.

A scale, for age determination, was removed from the left side of each fish approximately 2.5 cm behind the operculum and 2.5 cm below the lateral line. If scales were absent from this preferred area, a scale was removed from the right side of the fish in the same location, or anywhere a readable scale was present. Removed scales were dipped in 10% mucilage solution, mounted sculptured side up on glass slides, and read by annuli interpretation using a microfiche reader. Scales were aged by counting the annuli formed at the end of winter prior to spawning (Shaboneev 1965). This timing was coincidental to the collection of samples in the spawning migration; thus, the outer edge of the scale was counted as an annulus.

Standard length from tip of snout to the hypural plate at the base of the tail was measured to the nearest millimeter. Each herring was weighed to the nearest gram. Sex and maturity were determined for each herring by visual examination of the gonads, or sex products. Maturity of both male and female herring was rated by the eight-scale guideline outlined in Barton and Steinhoff (1980). These categories were combined and summarized as green (not ready to spawn), ripe (ready to spawn) or spent (already spawned).

Sample Sizes

Sample sizes were chosen to ensure that the desired sample size of a multinomial population would result in an estimate whereby each category would simultaneously fall within 5% ($\alpha=0.05$) of the true population age proportions 90% of the time (Thompson 1987). A sample size of 400 herring provides this level of precision and accuracy. Sample sizes required to

represent the biomass from test purse seines were 400 fish per 3-day strata, or 134 fish per day based on the time required to collect and process the herring. The sample size for each time strata for the commercial purse seine harvest was 400 herring per section. The sample size for each time strata for the commercial gillnet harvest was 150 herring per section per day.

Age, Weight and Length Data

Age composition of the commercial harvest was estimated from herring collected from the commercial and test fisheries throughout the Togiak District. The percent age composition by number, for each age class P_a , was estimated for each gear-time-area by:

$$P_a = \frac{n_a}{n} \quad (1)$$

where:

n_a = the number of herring in the sample that were age a and

n = the total number of herring in the sample.

The mean weight-at-age, \overline{W}_a for herring was estimated for each gear-time-area stratum by

$$\overline{W}_a = \frac{\sum_{i=1}^{n_a} W_{ai}}{n_a} \quad (2)$$

where:

W_{ai} = the individual weight of herring in sample n that were age a .

The mean length-at-age was calculated by substituting the individual length L_{ai} of herring for the individual weight W_{ai} .

COMMERCIAL HARVEST

Fish tickets (sales receipts) were completed by processing companies and buyers for each commercial delivery of herring. Estimates of waste or discarded herring were obtained from aerial survey estimates of discarded herring or processor reports. Estimated waste was included in the fish ticket database and used in the calculation of exploitation rates.

BIOMASS ESTIMATION

Herring biomass for the Togiak District was estimated using aerial survey assessment procedures outlined by Lebida and Whitmore (1985). When weather permitted, aerial surveys were flown daily at low tide to estimate herring biomass. Each management section was divided into index areas to facilitate survey documentation. Aerial survey estimates for each index area were summed to provide biomass estimates for each management section by day. Biomass estimates of these management sections were then summed to provide the observed district-wide biomass for each day.

Age information from the herring samples collected by nonselective gear were pooled across management sections to determine any temporal trends in age composition, which would

indicate immigration of new herring or emigration of herring from the fishing district after spawning.

Age composition, by weight, of the commercial harvest and of the appropriate daily biomass data for each age class was estimated by

$$B_a = \left[\frac{n_a \bar{W}_a}{\sum_{a=1}^{\max_a} (n_a \bar{W}_a)} \right] B, \quad (3)$$

where:

B_a = the biomass for age a ,

n_a = the number of herring in the sample that were age a ,

\bar{W}_a = the mean weight for herring of age a , and

B = the total estimated harvest expressed as biomass or daily biomass estimate.

Age composition of the waste, or deadloss, (i.e., herring that were caught but not sold) was represented by the age composition for the same gear type in the commercial fishery.

The number of fish for each age class, N_a , was calculated by

$$N_a = \frac{B_a}{W_a} \quad (4)$$

The run biomass, B_{tot} , was calculated by summing the biomass by each age class and management section from the selected daily aerial surveys.

$$B_{tot} = \sum_{i=1}^n B_i \quad (5)$$

where 1, 2, and 3 are aerial survey biomass estimates.

The inshore escapement biomass E_{tot} was the summation of the difference between the run biomass B_a , for each age and the combined purse seine and gillnet harvest for each age C_a :

$$E_{tot} = \sum_{a=1}^{maz} (B_a - C_a) \quad (6)$$

An age structured analysis (ASA) model (Funk et al. 1992) was used to forecast the 2006 total run (Appendix C1). Historical aerial survey total run biomass estimates are included in the model and weighted with the most recent estimate having the most influence. The last biomass estimate included in the model was from 2005 because inadequate aerial survey information has prevented the estimation of total run biomass estimates for 2002, 2003 and 2004.

RESULTS

BIOMASS ESTIMATE

Aerial surveys were flown in the Togiak Fishing District from 19 April–26 May (Table 2). The total run biomass estimate of 176,288 tons (159,927 tonnes) was calculated by combining the peak inseason biomass estimate of 124,711 tons (113,137 tonnes) observed on 13 May and the postseason aerial survey estimate from 26 May of 51,577 tons (46,790 tonnes) (Table 2).

Aerial survey conditions throughout the season were fair and ranged from poor to good. Aerial survey conditions were considered fair on 13 May when the peak inseason biomass estimate was observed as were conditions when the postseason biomass estimate was observed on 26 May (Table 2).

COMMERCIAL HARVEST

Commercial openings occurred from 12 May–21 May (Table 3). A total harvest of 23,953 tons (21,730 tonnes) occurred within the Togiak District for sac roe product (Table 1). The first commercial opening was on 12 May when a harvest of 3,292 tons (2,986 tonnes) occurred with most of the harvest (96.9%) occurring in the Togiak and Nunavachak Sections. On the final commercial opening a total of 1,884 tons (1,709 tonnes) were harvested with 85.8% of the catch coming from the Hagemeister section. Daily harvest during the commercial fishery ranged from a low of 805 tons (730 tonnes) on 19 May to a high of 3,595 tons (3,261 tonnes) on 18 May (Table 3).

The total average roe percentage (weighted) of all harvested herring was 9.7%. Total roe percentage ranged from 9.2% to 11.2% during the commercial fishery and varied among sections (Table 3).

Catches from Hagemeister Section accounted for 34.3% of the total commercial harvest, followed in magnitude by Kulukak (29.8%), Nunavachak (23.1%), Togiak (12.1%) and Pyrite Point (0.7%) (Table 3; Figure 3).

Purse Seine

There were nine commercial purse seine openings in the Togiak District from 12 May–21 May (Table 3). A total of 16,821 tons (15,260 tonnes) was harvested and included 500 tons (454 tonnes) estimated as dead loss. The duration of purse seine openings averaged 12.33 h with shortest opening occurring on 15 May (4 hours) and the longest opening (16 h) taking place on 20 May.

The first and largest purse seine opening was on 12 May when a harvest of 3,292 tons (2,986 tonnes) occurred. The majority of the first harvest (96.9%) was from the Togiak and Nunavachak Sections. The lowest daily purse seine harvest of 370 tons (336 tonnes) occurred on 19 May. The average daily commercial purse harvest was 1,804 tons (1,637 tonnes). Catches from Hagemeister Section accounted for 49% of the total purse seine harvest, followed in magnitude by Nunavachak (33%), Togiak (17%) and Pyrite Point (1%) (Table 3; Figure 4).

Total roe percentage (weighted) averaged 9.2% from purse seine harvested herring. Total roe percentage ranged from 8.5% to 10.3% and varied among sections, Nunavachak (9.3%), Togiak (9.0%), Hagemeister (9.0%), and Pyrite Point (9.9%) (Table 3).

Gillnet

There were nine commercial gillnet openings totaling 143.93 h from 13 May–21 May harvesting a total of 7,132 tons (6,470 tonnes) (Table 3).

The average daily commercial gillnet harvest was 792.4 tons (718.9 tonnes). The fishery peaked on 15 May, the third day of fishing, with a harvest of 1,407 tons (1,277 tonnes). The smallest commercial gillnet harvest of 230.5 tons (209.1 tonnes) occurred on 13 May (Table 3).

The roe percentage (weighted) from the commercial gillnet fishery averaged 10.8%. Roe percentage varied across time ranging from a low of 9.5% on 13 May to a high of 11.7% on 20 May (Table 3).

Catches from Kulukak Section accounted for 100% of the total gillnet harvest (Table 3).

Spawn on Kelp

No companies registered to buy herring spawn-on-kelp in 2006, therefore there were no openings or commercial harvests (Table 1). The last spawn-on-kelp fishery occurred in 2002.

EXPLOITATION RATE

The inseason exploitation rate was estimated to be 19.2%; the commercial sac roe harvest of 23,953 tons (21,730 tonnes) was divided by the peak inseason biomass of 124,711 tons (113,137 tonnes) (Table 1 and 2). An estimated 152,335 tons (138,197 tonnes) representing 370 million herring escaped harvest in the Togiak Fishery (Table 4).

The final postseason exploitation rate was estimated to be 14.1%; which was the commercial sac roe and Dutch Harbor food and bait harvests divided by the total run biomass estimate of 176,288 tons (159,927 tonnes) (Table 1).

AGE, SIZE AND SEX COMPOSITION

Commercial Harvest

The weighted age composition of the commercial harvest was calculated by combining the weighted age composition from the commercial purse seine and gillnet fishery (Table 4; Appendices A1 and A2). The age composition of the commercial harvest by weight was predominately age-9 (26.2%), age-8 (25.0%), and age-10 (15.3%) (Table 4; Figure 5).

The mean length and weight of herring was calculated from non-selective gear, test fishing (9-11 May) and purse seine (12–15 May), and used to estimate the inseason peak biomass. The mean length and weight of herring sampled was 296 mm and the mean weight was 396 g (Table 5; Appendices B1–B7). The sex compositions of all aged samples collected from commercial purse seine, gillnet, and test fishing, were 49.1% male and 50.9% female and varied over time (Appendices B1–B12).

Purse Seine

Herring samples were collected from commercial purse seine openings occurring on 12–15 May and 17–19 May from the Hagemeister, Nunavachak, and Togiak Sections (Appendices B1–B4).

Herring sampled from the purse seine fishery ranged from age-3 to age-18 (Table 4). Ages 8, 9 and 10 were the major age classes comprising 22.9%, 25.9% and 17.1%, of the commercial purse

seine harvest by weight and 23.3%, 24.5%, and 14.4%, by number (Table 4; Figure 6; Appendix A1)

The mean length and weight of herring was calculated from commercial purse seine samples collected on (12–15 May and 17–19 May) in the Hagemeister, Nunavachak, and Togiak Sections. The mean length of herring sampled from the purse seine harvest was 294 mm and mean weight was 386 g (Table 5; Appendices B1–B4). The sex composition of all aged samples from the commercial purse seine fishery was 49.8% male and 50.2% female and varied over time (Appendix B4).

A sample size of 4,231 was collected from the commercial purse seine fishery producing 3,773 readable scales and varied by section (Table 6). A total of 1,632 samples were collected from 12–15 May and from 17–18 May in the Hagemeister Section producing 1,437 (38.1%) of the total readable scales (Appendix B1). A total of 1,619 samples were collected from 12–15 May and from 19 May in the Nunavachak Section producing 1,458 (38.6%) of the total readable scales (Appendix B2). A total of 980 samples were collected from 12, 14, and 18 May in the Togiak Section producing 878 (23.3%) of the total readable scales (Appendix B3).

Gillnet

Herring samples were collected from commercial gillnet openings occurring on 13–17 May from the Kulukak and Nunavachak Section (Appendices B5–B7). A sample size of 765 was collected from the commercial gillnet fishery producing 659 readable scales; this includes 155 samples collected for genetics from the Nunavachak Section near Right Hand Pt. which bounds the Kulukak Section on 14 May (Table 6).

Herring sampled from the gillnet fishery ranged from age-4 to age-16 (Table 4). Age groups 8 and 9 were the major age classes comprising 28.9% and 37.7%, of the commercial gillnet harvest by weight and 30.5%, and 37.0%, by number (Table 4; Figure 6; Appendix A2). Herring age-10 and older composed 27.4% of the gillnet harvest by weight and 23.6% by number. Contribution of herring age-7 and younger was minimal, representing only 6.0% by weight and 8.8% by number (Table 4; Figure 6; Appendix A2).

Mean length of herring sampled from the commercial gillnet harvest was 302 mm and mean weight was 408 g (Table 5; Appendix B7). Sex composition varied over time, but sex composition of all aged samples from the gillnet fishery was 51.0% female and 49.0% male (Appendix B7).

Test Fishing

Herring samples were collected from test fishing on 9–11 May from the Hagemeister, Kulukak, and Nunavachak Sections. No samples were collecting from test fishing that occurred on 22 May (Appendices B8–B12). Herring sampled on 9–11 May from test fishing ranged from age-3 to age-17. Age groups 8 and -9 herring (43.1%), followed by age-4 and -5 (30.5%) were the major age classes comprising 73.6% of all herring sampled from test fishing (Appendices B8–B12).

The mean length of herring sampled from the test fishing was 284 mm and mean weight was 355 g (Appendices B8–B12). The sex composition varied over time, but sex composition of all aged samples from test fishing was 45.2% male and 54.8% female (Appendix B12).

A sample size of 722 was collected from test fishing producing 677 readable scales (Table 6). A total of 160 samples were collected from 10 May in the Hagemeister Section producing 150 (22.2%) of the total readable scales (Appendix B8). A total of 150 samples were collected from

11 May in the Kulukak Section producing 138 (20.4%) of the total readable scales (Appendix B9). A total of 262 samples were collected from 9–10 May in the Nunavachak Section producing 242 (35.7%) of the total readable scales (Appendix B10). A total of 150 samples were collected from 11 May in the Togiak section producing 147 (21.7%) of the total readable scales (Appendix B11).

AGE COMPOSITION OF POPULATION

The age composition of the inseason peak biomass estimate by weight was dominated by age-9 (28.1%), age-8 (23.0%), and age-10 (18.0%) herring (Table 4). Biological information was collected from 4,953 herring caught by purse seine gear (commercial catch and test fishing) in the Togiak Fishing District from 9 May–19 May 2006 (Table 6; Appendices B1–B4 and B8–B12). The age composition of herring samples collected with non-selective gear was used to estimate the age composition of the inseason peak biomass on 13 May and the postseason peak biomass on 26 May (Table 4).

Samples used to estimate the inseason peak biomass age composition was derived from individual sections (Appendix B13). Samples collected with non-selective gear from the Nunavachak (9–15 May) and Kulukak (11 May) Sections, were applied to the aerial survey biomass estimate of 20,787 tons (18,858 tonnes) observed 13 May in the Nunavachak and Kulukak Sections. Samples collected from the Hagemeister Section, 10 May and 12–15 May, were applied to the aerial survey biomass estimate of 74,480 ton (67,568 tonnes) observed 13 May in the Hagemeister Section. Samples collected with non-selective gear from the Togiak section, 11–13 May, were applied to the aerial survey biomass estimate of 29,444 ton (26,711 tonnes) observed 13 May in the Togiak Section.

The mean length of herring of the inseason peak biomass estimate was 296 mm and mean weight was 396 g (Table 5; Appendices B1–B7, and B13). The sex composition of the inseason peak biomass estimate was 48.2% male and 51.8% female (Appendix B13). The mean length and weight of herring was calculated from non-selective gear, test fishing (9–11 May) and purse seine (12–15 May), for the inseason biomass estimate.

Due to the lack of a postseason sampling program, samples collected with non-selective gear from Hagemeister, 17–18 May, Togiak, 18 May, and Nunavachak, 19 May, Sections were combined to estimate the age composition of the postseason peak biomass on 26 May. Age composition of the postseason peak biomass estimate by weight was dominated by age-8 (21.8%), age-9 (19.8%), and age-5 (18.9%), herring (Table 4).

We also looked at the combined age composition of herring samples collected with non-selective gear from the eastern and western areas of the Togiak District from the inseason and postseason peak biomass estimates (Figure 7). The age composition from the inseason peak biomass estimate was dominated by herring age-8, -9 and herring age-10 and older for both the eastern (74.9%) and western (80.2%) areas of the Togiak District. The age composition from the postseason peak biomass estimate was dominated by herring ages 4–5 (44.2%) and herring ages 8–9 (29.5%) in the eastern areas of the Togiak District. The age composition from the postseason peak biomass estimate was dominated by herring ages 8–9 (41.5%) and herring ages 4–5 (28.8%) in the western areas of the Togiak District.

DISCUSSION

The purpose of this study was to estimate the total run biomass, spawning escapement, and age, size (weight and length) and sex composition of herring in the Togiak District. The 2006 season was operated similarly to years past and was successful in providing needed inseason age composition estimates to area managers during the season. Another important purpose of this study is to gather the necessary data to forecast total run using an alternative approach (ASA), which in turn is used to set harvest guidelines.

The primary objective (Objective 1) of this study was achieved for herring in the Togiak District in 2006. The total run biomass estimate of 176,288 tons (159,927 tonnes) was the 3rd largest biomass estimate in the last 20 years (Table 1). The spawning escapement was an estimated 152,335 tons (138,197 tonnes) representing 370 million herring.

The total commercial harvest (Objective 2) of 23,953 tons (21,730 tonnes) was fifth highest in the last 20 years, which was also greater than the 10-year average of 21,258 tons (19,285 tonnes) (Table 7). The commercial fishery started on 12 May, which was the fourth latest starting date in the last 20 years (Table 7). The late start to the fishery can be attributed to a colder than normal spring. The average roe percent, 9.7%, for all harvested herring was less than 2005.

The duration of the commercial fishery was the longest in the last 20-years (Table 7). The effort by the commercial fleet, both gillnet and purse seine was the lowest in the last 20-years. This may be a result of fishers and processors forming coops in 2001 and working together to ensure quality in the harvest. This practice allows the purse seine fishermen to inspect their catches more closely, and harvest only the most valuable fish. Another factor in the duration of the fishery was that daily processing capacity was the third lowest in the last 20-years (Table 7).

The commercial purse seine harvest of 16,821 tons (15,260 tonnes) of herring was greater than the 20-year average of 14,916 tons (13,532 tonnes) by 12.7% (Table 7). The duration of the purse seine fishery was also the longest in the last 20-years (Table 7). The average roe percentage of 9.2% from the total purse seine harvest was the fourth lowest roe percentage in the last 20-years (Table 7).

The commercial gillnet harvest of 7,132 tons (6,470 tonnes) was the second largest in the last 20-years (Table 7). The duration of the gillnet fishery was also the fourth longest in the last 20-years. The average roe percentage of 10.8% from the commercial gillnet fishery was 0.5% greater than the 20-year average.

Sampling efforts to estimate the age, size (weight and length) and sex composition, of herring harvested in the commercial harvest were considered adequate and representative of the population (Objective 3). The number of readable scales (3,773) collected from the commercial purse seine fishery was similar to the previous two years, but less than the 2000's average of 4,679 readable scales. Aged samples from the commercial purse seine fishery were dominated by age-8 (23.3%), age-9 (24.5%), and age-10 (14.4%) herring (Table 5). The size (weight and length) for herring age-8 (380g and 295 mm), age-9 (416g and 303 mm), and age-10 (472g and 316 mm) was greater than in 2005 (Table 5). The weight for age-8, -9, -10 herring was greater than the 20-year average for these age classes. The sex composition of males (49.8%) was less than the previous year, while females (50.2%) were greater than the previous year (Appendices B1–B4).

The number of readable scales (659) collected from the commercial gillnet fishery was similar to last year, but less than the 2000's average of 4,679 readable scales. Aged samples from the commercial gillnet fishery were dominated by age-8 (30.7%), age-9 (38.5%), and age-10 (16.4%) herring (Table 5). The size (weight and length) for herring age-8 (383g and 295 mm), age-9 (414g and 304 mm), and age-10 (456g and 314 mm) sampled in 2006 was greater than the previous year (Table 5). The sex composition of males (49.0%) was greater than the previous year, while females (51.0%) were less than the previous year (Appendices B5–B7).

The number of readable scales (677) collected from test fishing was greater than the previous year, but still less than the 2000's average of 817 readable scales.

Estimates of the age class contribution to the total run biomass and commercial harvest of herring in Togiak District were made during 2006 (Objective 4). Herring age-8, -9, and -10 comprised 69.1% of the total run biomass estimate (Table 4), which was less than last year, 72.1%, when these herring were age-7, -8, and -9 (Figure 8). The age composition of the commercial harvest was comprised primarily of herring age-8, -9, and -10 (66.5%) by weight (Table 4), which was 6.8% less than last year when these herring were age-7, -8, and -9 (Figure 8).

A temporal change in age composition from older to younger herring that typically occurs in the fishery was not observed during 2006. Herring age-4 and age-5 (12.6%), also made a larger than expected contribution to the commercial fishery by weight, comprising a larger portion of the commercial purse seine harvest as the season progressed (Table 4; Appendices B1–B7). The larger than expected return of age-4 and age-5 fish observed in the fishery may suggest a strong recruit class in the future. Large recruitment events have been observed approximately every eight to ten years in the Togiak herring population with the most recent events occurring from the 1996 and 1997 year classes (Figure 8).

One issue with measuring the true strength of these recruit age classes is the lack of postseason age composition sampling. This limits our ability to assess the age contribution to the biomass based on the aerial survey conducted on 26 May. The younger recruit age classes, age-4 and age-5 herring, generally spawn later than older fish and therefore are typically underrepresented when postseason sampling is not conducted.

The inseason and postseason exploitation rate of herring in the Togiak District was also estimated in 2006 (Objective 5). The inseason exploitation rate of 19.2% was similar to last year's rate of 19.3% (Table 1). The overall exploitation rate of 14.1% was the same as 2005 and less than the 20-year average (Table 1).

Observations of herring spawn, linear miles, were down again in 2006 (Table 8). Herring spawn was first documented and peaked on 12 May when 5.6 linear miles were observed (Table 2). A total of 17.8 linear miles of spawn was documented throughout the 2006 survey period (Table 8). This observation of 17.8 linear miles of spawn was lower than the recent 10-year average of 51.5 linear miles and the lowest in the last 20-years (Table 8). The lower than expected observed herring spawn may have occurred from one or more of the following: (1) aerial survey conditions were better in previous years, (2) herring may have spawned less, or (3) herring may have spawned deeper, or spawn was mixed in turbid water making observations difficult.

ACKNOWLEDGEMENTS

I wish to thank the following Alaska Department of Fish and Game, Division of Commercial Fisheries personnel for contributing to this report. Eric Barnhill, Kiana Putman, and Simon Prennace collected herring data. Tim Sands and Charlotte Westing provided daily biomass estimates. Bristol Whitmore, Simon Prennace, and Phil Carpenter provided logistical support. Lowell Fair, Tim Baker, Fred West and Scott Raborn provided critical review of the manuscript. I also wish to thank all the fishers who collected samples.

REFERENCES CITED

- Barton, L. H., and D. L. Steinhoff. 1980. Assessment of spawning herring (*Clupea harengus pallasii*) stocks at selected coastal areas in the eastern Bering Sea. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 78, Juneau.
- Brazil, C. 2007. Abundance, age, sex and size statistics for Pacific herring in the Togiak District of Bristol Bay, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-20, Anchorage. <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds07-20.pdf>
- Fried, S. M., C. Whitmore, and D. Bergstrom. 1982a. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii*, from eastern Bering Sea coastal spawning sites, Alaska, 1981. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 78, Juneau.
- Fried, S. M., C. Whitmore, and D. Bergstrom. 1982b. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii*, from eastern Bering Sea coastal spawning sites, Alaska, 1982. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 79, Juneau.
- Fried, S. M., C. Whitmore, and D. Bergstrom. 1983a. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii*, from eastern Bering coastal spawning sites, Alaska, 1964-1976. Alaska Department of Fish and Game, Division of Commercial fisheries, Technical Data Report 84, Juneau.
- Fried, S. M., C. Whitmore, and D. Bergstrom. 1983b. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii*, from eastern Bering coastal spawning sites, Alaska, 1977-1978. Alaska Department of Fish and Game, Division of Commercial fisheries, Technical Data Report 85, Juneau.
- Fried, S. M., C. Whitmore and D. Bergstrom. 1984. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii*, from eastern Bering Sea coastal spawning sites, Alaska, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 105, Juneau.
- Funk F. 1990. Migration of eastern Bering Sea herring as inferred from 1983-1990 joint venture and foreign trawl bycatch rates. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J90-04, Juneau.
- Funk F., L. K. Brannian, K. A. Rowell. 1992. Age-structured assesment of the Togiak herring stock, 1978-1992, and preliminary forecast of abundance for 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J92-11, Juneau.
- Lebida, R. C., and D. C. Whitmore. 1985. Bering Sea herring aerial survey manual. Alaska Department of Fish and Game, Division of Commercial Fisheries, Bristol Bay Data Report 85-2, Anchorage.
- Lebida, R. C., D. C. Whitmore, and G. J. Sandone. 1985a. Age, sex and size composition of Pacific herring, *Clupea harengus pallasii* from eastern Bering Sea coastal spawning sites, Alaska, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 138, Juneau.
- Lebida, R. C., D. C. Whitmore, and G. J. Sandone. 1985b. Pacific herring stocks and fisheries in the eastern Bering Sea, Alaska, 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 187, Juneau.

REFERENCE CITED (Continued)

- Lebida, R. C. 1987. Age, size and sex composition of Pacific herring (*Clupea harengus pallasii*) from eastern Bering Sea coastal spawning sites, 1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 216, Juneau.
- Lebida, R. C., and G. J. Sandone. 1990. Age, size and sex composition of Pacific herring (*Clupea harengus pallasii*) from eastern Bering Sea coastal spawning sites, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report, 88-06, Juneau
- McBride, D., and C. Whitmore. 1981. Age composition of Pacific herring, *Clupea harengus pallasii* (Valenciennes) in the Togiak District of Bristol Bay during the 1979 and 1980 spawning seasons. Alaska Department of Fish and Game, Division of Commercial Fisheries, Information Leaflet 191, Juneau.
- McBride, D., C. Whitmore, and D. Bergstrom. 1981. Age, sex, and size composition of Pacific herring, *Clupea harengus pallasii* (Valenciennes) from selected coastal spawning sites along the eastern Bering Sea, 1979-1980. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 61, Juneau.
- Rowell, K. A., H. J. Geiger, and B. G. Bue. 1991. Stock identification of Pacific herring in the eastern Bering Sea trawl bycatch. Pages 255-278 [In]: Proceedings of the International Herring Symposium. Alaska Sea Grant Report 91-01.
- Rowell, K. A. 1995. Abundance, age, sex and size statistics for Pacific herring, in the Togiak District of Bristol Bay, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report No. 95-11, Juneau
- Rowell, K. A. 2002a. Abundance, age, sex and size statistics for Pacific herring, in the Togiak District of Bristol Bay, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report No. 99-12, Anchorage.
- Rowell, K. A. 2002b. Abundance, age, sex and size statistics for Pacific herring, in the Togiak District of Bristol Bay, 1990-1992. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A02-15, Anchorage.
- Rumyantsev, A. I. and M. A. Darda. 1970. Summer herring in the eastern Bering Sea. [In]: Soviet fisheries investigations in the northeastern Pacific, Part V: 409-41. Edited by P. A. Moiseev. Translated by Israel Program for Scientific Translations, Jerusalem, 1972.
- Sandone, G. J., and L. K. Brannian. 1988. Estimated age-class contribution of Pacific herring to the commercial sac-roe harvests of Togiak District, 1980-1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A88-12, Anchorage.
- Schwanke, C. J. 2003. Abundance, age, sex and size statistics for Pacific herring in the Togiak District of Bristol Bay, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-16, Anchorage.
- Selkregg, L. L. 1976. Alaska regional profiles - Southcentral. University of Alaska, Arctic Environmental and Information Data Center, Anchorage.
- Shaboneev, I. E. 1965. Biology and fishing of herring in the eastern part of the Bering Sea. [In]: Soviet fisheries investigations in the northeastern Pacific Part IV: 130-54. Edited by P. A. Moiseev. Translated by Israel Program for Scientific Translations, Jerusalem, 1968.
- Thompson, S. K. 1987. Sample sizes for estimating multinomial proportions. The American Statistician 41:42-46.
- Wespestad, V. G., and L. H. Barton. 1981. Distribution, biology and stock assessment of Pacific herring. Pages 509 to 525 [In]: Hood, D. W. and J. A. Calder, editors. The eastern Bering Sea shelf: oceanography and resources, Vol. I. U.S. Department of Commerce, NOAA, Office of Marine Pollution Assessment, Juneau.
- West F. W. 2002. Abundance, age, sex and size statistics for Pacific herring in the Togiak District of Bristol Bay, 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A02-23, Anchorage.
- West, F. W., D. L. Crawford, and C. J. Schwanke. 2003. Abundance, age, sex and size statistics for Pacific herring, in the Togiak District of Bristol Bay, 1993-2000. Alaska Department of Fish and Game Division of Commercial Fisheries, Regional Information Report 2A03-19, Anchorage.

TABLES AND FIGURES

Table 1.—Historical total run biomass and commercial harvest (tons) of Pacific herring returning to the Togiak District, Bristol Bay, 1968–2006.

Year	Togiak		Spawn-on-Kelp			Dutch Harbor	Exploitation Rate ^h
	Total Run Biomass (tons) ^{a,b}	Sac Roe Harvest (tons) ^c	Harvest (lbs) ^c	Harvest (tons) ^c	Herring Equivalent (tons) ^d	Food and Bait Harvest (tons) ^e	
1968		80					
1969		47	10,125	5			
1970		28	38,855	19			
1971		^f	51,795	26			
1972		80	64,165	32			
1973		51	11,596	6			
1974		123	125,646	63			
1975		56	111,087	56			
1976		^f	295,780	148			
1977		2,795	275,774	138			
1978	190,292	7,734	329,858	165			
1979	239,022	11,558	414,727	207			
1980	68,686	24,516	189,662	95			
1981	158,650	12,489	378,207	189		704	
1982	97,902	21,821	234,924	117		3,565	
1983	233,700	26,786	274,866	137		3,567	
1984	114,880	19,419	406,587	203	1,552	3,578	
1985	131,400	25,812	^f	^f	^f	3,480	
1986	94,770	16,276	374,142	187	1,446	2,394	
1987	88,398	15,530	307,307	154	1,309	2,503	
1988	134,718	14,168	489,400	245	1,782	2,004	
1989	98,965	12,259	559,754	280	2,499	3,081	
1990	88,105	12,230	413,844	207	1,617	820	
1991	83,229	14,970	348,357	174	1,310	1,325	
1992	156,957	25,808	363,600	182	1,482	1,949	
1993	193,847	17,956	383,000	192	1,481	2,790	11.5%
1994	185,412	30,315	308,400	154	1,134	3,349	18.8%
1995 ^g	149,093	26,732	281,600	141	996	1,748	ⁱ
1996 ^g	135,585	24,871	455,800	228	1,899	2,239	ⁱ
1997	144,887	23,813	^f	^f	^f	1,950	17.8%
1998 ^g	121,000	22,776	^f	^f	^f	1,994	ⁱ
1999	157,028	19,878	419,563	210	1,605	2,398	15.2%

-continued-

Table 1.—Page 2 of 2.

Year	Togiak		Spawn-on-Kelp			Dutch Harbor	
	Total Run Biomass (tons) ^{a,b}	Sac Roe Harvest (tons) ^c	Harvest (lbs) ^c	Harvest (tons) ^c	Herring Equivalent (tons) ^d	Food and Bait Harvest (tons) ^e	Exploitation Rate ^h
2000	130,904	20,421	f	f	f	2,014	i
2001 ^j	115,155	22,330	f	f	f	1,439	20.6%
2002 ^g	120,196	17,049	67,793	34	260	2,751	i
2003 ^g	126,213	21,663	k	k	k	1,487	i
2004 ^g	143,124	18,868	f	f	f	1,258	i
2005	156,727	19,711	f	f	f	1,154	14.1%
2006	176,288	23,953	f	f	f	953	14.1%
1986–2005 Mean ^l	131,216	19,941	367,120	184	1,448	2,032	16.3%
1996–2005 Mean ^m	135,082	21,258	314,385	118	1,255	1,868	16.9%

^a Data not available prior to 1978.

^b Source: ADF&G (2002).

^c Source: ADF&G (1988; 1968–1979); Sandone and Brannian (1988; 1980–1987); fish ticket receipts, 1988–2002.

^d Management plan adopted by Board of Fisheries in 1984 setting a 350,000 lb. harvest guideline, specifying 2 to 3 year rotation, and including spawn-on-kelp herring equivalent in exploitation rate. Herring equivalent calculation reported in ADF&G (1997).

^e Source: ADF&G (2002); catches documented since 1929. Fishery did not occur between 1946 and 1980.

^f No fishery conducted.

^g Aerial surveys to determine abundance were hampered by poor weather conditions preventing calculation of a final season's biomass estimate. Inseason management used preseason forecast.

^h Exploitation rate calculated from reliable total run biomass postseason estimates beginning in 1993.

ⁱ Exploitation rate not calculated as no total run biomass was estimated.

^j The 2001 total run biomass estimate was determined to be high and was reduced from 146,000 tons to 115,155 tons.

^k Data confidential under Alaska Statute 16.05.815

^l The 1983–2002 calculated mean for spawn-on-kelp fishery does not include years 1985, 1997, 1998, 2000 and 2001 and the calculated mean harvest for the Dutch Harbor food and bait fishery does not include 1979 and 1980.

^m The 1993–2002 calculated mean for the spawn on kelp fishery does not include years 1997,1998, 2000 and 2001.

Table 2.—Aerial survey estimates (tons) of herring by index area, Togiak District, 2006.

Date	Start Time	Survey ^b Rating	Miles of Spawn	Estimated Biomass by Index Area ^a												Daily ^d Total		
				NUS	KUK	MET	NVK	UGL	TOG	TNG	MTG	OSK	PYR	CPN	HAG		WAL	
4/19	11:25	2.8																
4/24	13:05	3.2																
4/27	10:00	2.6																
5/01	10:40	3.2																
5/03	13:05	2.6																
5/04	10:00	2.7																
5/08	15:10	2.9																
5/09	14:20	3.1					194.7	7.6										202
5/10	13:30	2.8			3	2,644									4,466	997		8,110
5/11	13:10	2.7		34	24,738	216	110	248	29,023	20,369	5,107	244			3,658			83,747
5/12	15:00		5.6 ^c															0
5/13	12:30	3.3	4.2	2,669	11,827	638	3,778	1,875	29,444	15,104	50,887	7,722	612		155			124,711
5/14	19:30	4.0	4.0 ^c															0
5/15	10:00	4.0	1.8 ^c															0
5/17	09:45	4.0	1.5 ^c															0
5/26	15:40	3.0	0.7	2,243	13,749	5,021	1,170	400	22,982	4,042	817	1,129			24			51,577
Total		3.1	17.8												Peak Biomass			124,711

^a Index areas: NUS - Nushagak Peninsula; KUK - Kulukak; MET - Metervik; NVK - Nunavachak; UGL - Ungalikthluk/Togiak; TOG - Togiak; TNG - Tongue Pt; MTG - Matogak; OSK - Osviak; PYT - Pyrite Point; CPN - Cape Newenham; HAG - Hagemeister; WAL – Walrus Islands.

^b 1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor, 5 = Unsatisfactory.

^c Vessel count and spawn survey only.

^d The 2005 Togiak District Pacific herring biomass was estimated at 156,757 (tons). This is the sum of:

1) Peak biomass aerial survey estimate of 108,585 (tons) observed May 1.

2) Aerial biomass estimates of 45,709 (tons) observed May 16 and 2,433 (tons) observed May 26.

Table 3.—Commercial herring harvest (tons) by fishing section, gear type, Togiak District, Bristol Bay, 2006.

Date	Duration	Periods	Kulukak		Nunavachak		Togiak		Hagemeister		Pyrite Point		Cape Newenham		Total	
			Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %
Purse Seine																
12-May	14:00	1			1552.6	9.2	1635.8	9.2	103.5	9.5	0.0	0.0	0.0	0.0	3,292	9.2
13-May	14:00	2			1855.2	9.1	95.6	7.8	548.5	9.7	0.0	0.0	0.0	0.0	2,499	9.2
14-May	14:00	3			1013.3	10.0	107.4	9.5	1,169.4	9.2	0.0	0.0	0.0	0.0	2,290	9.6
15-May	4:00	4			740.0	10.0	0.0	0.0	263.0	9.4	0.0	0.0	0.0	0.0	1,003	10.3
17-May	12:00	5			30.9	8.4	34.4	11.0	1,515.7	9.1	172.8	9.9	0.0	0.0	1,754	9.3
18-May	13:59	6			110.0	9.0	949.9	8.6	1,396.7	8.4	0.0	0.0	0.0	0.0	2,457	8.5
19-May	15:00	7			171.1	8.9	69.9	8.8	129.2	8.4	0.0	0.0	0.0	0.0	370	8.7
20-May	16:00	8			60.6	9.0	0.0	0.0	896.2	8.8	0.0	0.0	0.0	0.0	957	8.8
21-May	10:00	9			0.0	0.0	0.0	0.0	1,617.3	9.2	0.0	0.0	0.0	0.0	1,617	9.2
22-May									582.3	9.3					582	9.3
Subtotal	112:59:00				5,533.7	9.3	2893.0	9.0	8,222.0	9.0	172.8	9.9	0.0	0.0	16,821	9.2
Gillnet																
13-May	6:00	1	230.5	9.5											231	9.5
14-May	10:00	2	767.9	10.6											768	10.6
15-May	23:59	3	1,407.4	10.5	0	0.0									1,407	10.5
16-May	23:59	4	974.3	10.8	0	0.0									974	10.8
17-May	23:59	5	1332.2	10.4	0	0.0									1,332	10.4
18-May	23:59	6	1077.0	11.0	0	0.0									1,077	11.0
19-May	20:00	7	545.3	11.3	0	0.0									545	11.3
20-May	8:00	8	530.1	11.7											530	11.7
21-May	4:00	9	266.9	11.2											267	11.2
Subtotal	143:56:00		7,131.6	10.8	0.0	0.0									7,132	10.8

-continued-

Table 3.–Page 2 of 2.

Date	Duration	Periods	Kulukak		Nunavachak		Togiak		Hagemeister		Pyrite Point		Cape Newenham		Total	
			Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %	Tons	Roe %
Combined																
12-May					1,552.6	9.2	1,635.8	9.2	103.5	9.5	0.0	0.0	0.0	0.0	3,292	9.2
13-May			230.5	9.5	1,855.2	9.1	95.6	7.8	548.5	9.7	0.0	0.0	0.0	0.0	2,730	9.2
14-May			767.9	10.6	1,013.3	10.0	107.4	9.5	1,169.4	9.2	0.0	0.0	0.0	0.0	3,058	9.8
15-May			1,407.4	10.5	740.0	10.0	0.0	0.0	263.0	9.4	0.0	0.0	0.0	0.0	2,410	10.5
16-May			974.3	10.8	30.9	8.4	0.0	0.0	0.0	0.0	172.8	9.9	0.0	0.0	1,178	11.2
17-May			1,332.2	10.4	110.0	9.0	34.4	11.0	1,515.7	9.1	0.0	0.0	0.0	0.0	2,992	9.7
18-May			1,077.0	11.0	171.1	8.9	949.9	8.6	1,396.7	8.4	0.0	0.0	0.0	0.0	3,595	9.3
19-May			545.3	11.3	60.6	9.0	69.9	8.8	129.2	8.4	0.0	0.0	0.0	0.0	805	10.4
20-May			530.1	11.7	0.0	0.0	0.0	0.0	896.2	8.8	0.0	0.0	0.0	0.0	1,426	9.9
21-May			266.9	11.2	0.0	0.0	0.0	0.0	1,617.3	9.2	0.0	0.0	0.0	0.0	1,884	9.5
22-May									582.3	9.3					582	9.3
Total			7,131.6	10.8	5,533.7	9.3	2893.0	9.0	8,222.0	9.0	172.8	9.9	0.0	0.0	23,953	9.7

^a Includes test fish harvest which is conducted during closed commercial periods.

^b Includes 500 tons documented waste.

Table 4.—Harvest, inseason biomass, total run biomass, and escapement by age from the herring sac roe fishery, Togiak District, 2006.

Purse Seine					Gillnet					Total Harvest				
Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.	Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.	Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.
3	19	0.1	73	0.1	3	0	0.0	0	0.0	3	19	0.1	73	0.1
4	613	2.3	2,932	4.7	4	160	0.8	684	1.5	4	772	3.2	3,616	6.1
5	1,876	7.8	7,137	12.5	5	380	1.9	1,453	3.3	5	2,256	9.4	8,590	14.6
6	848	3.9	2,705	5.2	6	103	0.7	353	1.0	6	952	4.0	3,058	5.2
7	937	5.5	2,126	5.1	7	295	2.6	812	3.1	7	1,231	5.1	2,938	5.0
8	3,802	22.9	9,176	23.3	8	2,195	28.9	5,225	30.5	8	5,997	25.0	14,401	24.5
9	4,024	25.9	9,070	24.5	9	2,243	37.7	4,921	37.0	9	6,267	26.2	13,992	23.8
10	2,561	17.1	5,123	14.4	10	1,104	18.9	2,200	16.9	10	3,665	15.3	7,323	12.4
11	417	2.7	738	2.0	11	139	2.2	241	1.7	11	555	2.3	979	1.7
12	921	6.2	1,618	4.6	12	311	3.5	577	2.9	12	1,232	5.1	2,196	3.7
13	222	1.6	351	1.1	13	71	0.9	146	0.8	13	293	1.2	496	0.8
14	298	1.9	534	1.4	14	78	0.8	121	0.6	14	376	1.6	655	1.1
15	146	1.0	246	0.7	15	21	0.5	35	0.4	15	167	0.7	281	0.5
16	87	0.5	131	0.3	16	32	0.6	49	0.4	16	120	0.5	181	0.3
17	31	0.3	47	0.2	17	0	0.0	0	0.0	17	31	0.1	47	0.1
18	21	0.2	30	0.1	18	0	0.0	0	0.0	18	21	0.1	30	0.1
Total	16,821	100.0	42,037	100.0	Total	7,132	100.0	16,818	100.0		23,953	100.0	58,855	100.0

-continued-

Table 4.–Page 2 of 3.

Inseason Biomass					Postseason Biomass					Total Run Biomass				
Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.	Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.	Age	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.
3	54	0.0	248	0.1	3	0	0.0	0	0.3	3	54	0.0	248	0.1
4	2,841	2.0	14,275	4.4	4	3,494	6.8	16,778	11.6	4	6,335	1.8	31,053	5.9
5	7,315	6.1	27,027	9.9	5	9,740	18.9	37,250	25.7	5	17,055	5.4	64,277	13.2
6	3,833	3.1	12,171	4.4	6	3,881	7.5	12,776	8.8	6	7,714	2.8	24,947	5.3
7	5,304	4.0	13,973	4.6	7	2,849	5.5	7,542	5.2	7	8,154	5.4	21,515	4.7
8	27,835	23.0	66,025	23.8	8	11,245	21.8	27,399	18.9	8	39,080	25.9	93,423	22.8
9	34,013	28.1	73,472	26.5	9	10,202	19.8	23,243	16.0	9	44,216	26.7	96,715	24.3
10	21,265	18.0	40,339	15.0	10	5,660	11.0	11,390	7.9	10	26,925	16.4	51,729	13.5
11	4,263	3.0	7,570	2.3	11	1,017	2.0	1,847	1.3	11	5,280	3.6	9,417	2.1
12	8,590	6.5	14,338	4.7	12	1,985	3.8	3,540	2.4	12	10,575	6.0	17,878	4.2
13	2,719	1.8	4,370	1.3	13	406	0.8	616	0.4	13	3,126	1.7	4,986	1.1
14	3,081	1.9	4,953	1.4	14	737	1.4	1,385	1.0	14	3,818	1.9	6,338	1.3
15	1,729	1.2	2,875	0.9	15	256	0.5	462	0.3	15	1,985	1.2	3,337	0.8
16	937	0.6	1,461	0.4	16	104	0.2	308	0.2	16	1,041	0.6	1,769	0.3
17	623	0.5	954	0.3	17	0	0.0	0	0.0	17	623	0.4	954	0.2
18	308	0.2	452	0.1	18	0	0.0	0	0.0	18	308	0.2	452	0.1
Total	124,711	100.0	284,502	100.0	Total	51,577	100.0	144,536	100.0	Total	176,288	100.0	429,037	100.0

-continued-

Table 4.–Page 2 of 3.

Age	Escapement			
	Biomass ST	Percent by Wt	Number (x 1,000)	Percent by No.
3	35	0.0	174	0.0
4	5,563	3.7	27,437	7.4
5	14,799	9.7	55,688	15.0
6	6,762	4.4	21,889	5.9
7	6,923	4.5	18,578	5.0
8	33,084	21.7	79,022	21.3
9	37,948	24.9	82,724	22.3
10	23,260	15.3	44,406	12.0
11	4,725	3.1	8,438	2.3
12	9,343	6.1	15,682	4.2
13	2,833	1.9	4,490	1.2
14	3,442	2.3	5,683	1.5
15	1,818	1.2	3,055	0.8
16	922	0.6	1,588	0.4
17	592	0.4	908	0.2
18	287	0.2	421	0.1
Total	152,335	100.0	370,183	100.0

Table 5.—Mean length (mm), weight (g), and standard deviation by age for herring of the commercial harvest by gear type, Togiak District, 2006.

Inseason Biomass ^a						Commercial Purse Seine						Commercial Gillnet					
Age	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD	Age	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD	Age	Number of Samples	Mean Length (mm)	SD	Mean Weight (g)	SD
3	2	243	9.2	194	38.9	3						3					
4	154	238	11.3	184	33.3	4	176	241	9.6	190	26.2	4	8	249	9.5	212	33.6
5	347	259	9.4	245	33.8	5	470	258	8.4	242	31.0	5	17	258	9.5	237	27.5
6	153	271	7.8	286	35.9	6	196	270	8.1	281	35.2	6	5	271	9.7	281	49.4
7	161	286	7.4	344	38.9	7	191	286	7.6	345	39.2	7	21	287	9.5	348	43.7
8	836	294	6.8	382	39.9	8	878	295	6.8	380	39.5	8	202	295	6.3	383	33.0
9	930	303	7.1	419	43.5	9	925	303	6.8	416	43.7	9	254	304	6.6	414	34.5
10	526	316	6.5	477	45.8	10	542	316	6.5	472	47.3	10	108	314	6.2	456	38.6
11	82	321	7.4	509	55.6	11	75	322	7.1	509	56.2	11	10	324	8.2	507	26.3
12	166	327	7.6	542	53.0	12	173	328	7.3	537	54.1	12	21	325	6.7	508	39.6
13	44	330	8.2	559	55.3	13	40	331	9.1	563	59.0	13	5	333	9.5	498	66.8
14	48	331	7.3	562	57.9	14	52	330	14.6	550	81.1	14	3	329	2.9	550	58.5
15	31	331	10.0	543	57.9	15	27	332	10.1	545	65.4	15	2	334	4.9	523	75.0
16	13	340	8.1	594	68.2	16	13	340	7.8	602	58.1	16	3	342	8.4	594	44.6
17	11	335	7.1	590	53.3	17	7	338	6.9	606	37.0	17					
18	4	344	11.0	618	50.6	18	4	344	11.0	618	50.6	18					
All Samples Combined	3,508	296	23.8	396	102.0		3,773	294	24.3	386	103.4		659	302	15.1	408	64.1

^a Collected from non-selective gear, commercial purse seine.

Table 6.—Number of samples collected by gear type, Togiak District, 2006.

Gear Type	Number of Readable Scale Samples	Number of Unreadable Scale Samples	Total	% Unreadable Scale Samples
Commercial Purse Seine	3,773	458	4,231	10.8
Commercial Gillnet	659	106	765	13.9
Test Purse Seine	677	45	722	6.2
Total	5,109	609	5,718	10.7

Table 7.—Sac roe herring industry participation, fishing effort and harvest, Togiak District 1986–2006.

Year	Number of Buyers	Daily Processing Capacity ^a	Fishery Dates	Gillnet					Purse Seine					Total Harvest ^c
				Effort ^b	Duration (hours)	Harvest ^c	CPUE	Roe %	Effort ^b	Duration (hours)	Harvest ^c	CPUE	Roe %	
1986	23		5/14-5/15	209	10.0	3,448	1.6	8.8	209	1.0	12,828	61.4	9.9	16,276
1987	18		4/27-5/6	148	36.0	2,685	0.5	8.6	111	5.5	12,845	21.0	8.9	15,530
1988	22		5/17	300	4.0	3,695	3.1	8.3	239	0.5	10,472	87.6	10.9	14,167
1989	19		5/9-5/14	320	5.0	2,844	1.8	7.8	310	3.0	9,415	10.1	8.5	12,259
1990	16	3,100	5/8-5/20	277	66.0	3,072	0.2	9.0	221	3.0	9,158	13.8	9.7	12,230
1991	16	3,350	5/10-5/17	170	14.0	3,182	1.3	8.5	200	3.0	11,788	19.6	10.0	14,970
1992	18	3,700	5/20-5/27	274	25.5	5,030	0.7	8.8	301	0.3	20,778	230.1	9.2	25,808
1993	12	2,500	4/27-5/9	75	144.5	3,564	0.3	10.1	140	33.8	14,392	3.0	9.6	17,956
1994	16	3,300	5/11-5/20	146	76.0	7,462	0.7	12.0	240	4.6	22,853	20.7	9.4	30,315
1995	22	4,350	5/7-5/15	250	33.5	6,995	0.8	12.0	254	12.2	19,737	6.4	10.1	26,732
1996	19	4,850	5/3-5/8	461	18.0	6,863	0.8	11.1	268	2.4	18,008	27.8	9.0	24,871
1997	18	4,200	5/2-5/6	336	24.0	5,164	0.6	11.8	231	6.4	18,649	12.6	9.4	23,813
1998	15	2,475	4/29-5/10	152	46.0	5,952	0.9	12.5	123	16.5	16,824	8.3	9.6	22,776
1999	12	2,400	5/18-5/26	171	28.0	4,858	1.0	11.5	96	4.7	15,020	33.3	9.2	19,878
2000	12	2,100	5/6-5/14	227	67.0	5,464	0.4	10.6	90	15.8	14,957	10.6	10.1	20,421
2001	11	2,255	5/6-5/13	96	84.0	6,481	0.8	10.6	64	26.0	15,849	9.5	9.2	22,330
2002	8	1,920	5/3-5/13	82	102.0	5,216	0.6	10.9	37	57.5	11,833	5.6	9.3 ^d	17,049
2003	7	1,920	4/25-5/7	75	142.0	6,505	0.6	10.9	35	110.2	15,158	3.9	8.9 ^d	21,663
2004	6	2,150	4/29-5/9	54	162.0	4,980	0.6	10.4	31	78.0	13,888	5.7	9.5	18,868
2005	8	2,330	4/30-5/8	56	149.0	5,841	0.7	11.2	33	83.0	13,869	5.1	9.6	19,711
2006	7	2,060	5/12-5/21	49	143.9	7,132	1.0	10.8	28	113.0	16,821	5.3	9.2	23,953
1986–2005 Ave.	15	2,931		194	61.8	4,965	0.9	10.3	162	23.4	14,916	29.8	9.5	19,881
1996–2005 Ave.	12	2,660		171	82.2	5,732	0.7	11.2	101	40.0	15,406	12.2	9.5	21,138

^a Number of tons per day based on companies registered.

^b Peak aerial survey count.

^c Harvest total does not include deadloss and test fish harvest.

^d Values are lower than inseason assessment due to more stringent postseason market scrutiny compared with previous years.

Table 8.—Aerial survey estimates of herring spawn deposition, Togiak District 1986–2006.

Year	Spawn Estimates	
	Observations	Miles
1986	182.0	66.5
1987	160.0	75.8
1988	107.0	61.1
1989	69.0	52.5
1990	94.0	65.7
1991	90.0	69.5
1992	160.0	96.9
1993	76.0	53.4
1994	80.0	71.9
1995	70.0	58.7
1996	99.0	72.9
1997	79.0	59.1
1998	42.0	33.0
1999	33.0	56.0
2000	71.0	46.0
2001	100.0	57.0
2002	79.0	32.0
2003	182.0	94.7
2004	47.0	36.4
2005	106.0	27.6
2006	66.0	17.8
1986–2005 Average	98.4	58.6
1996–2005 Average	83.8	51.5

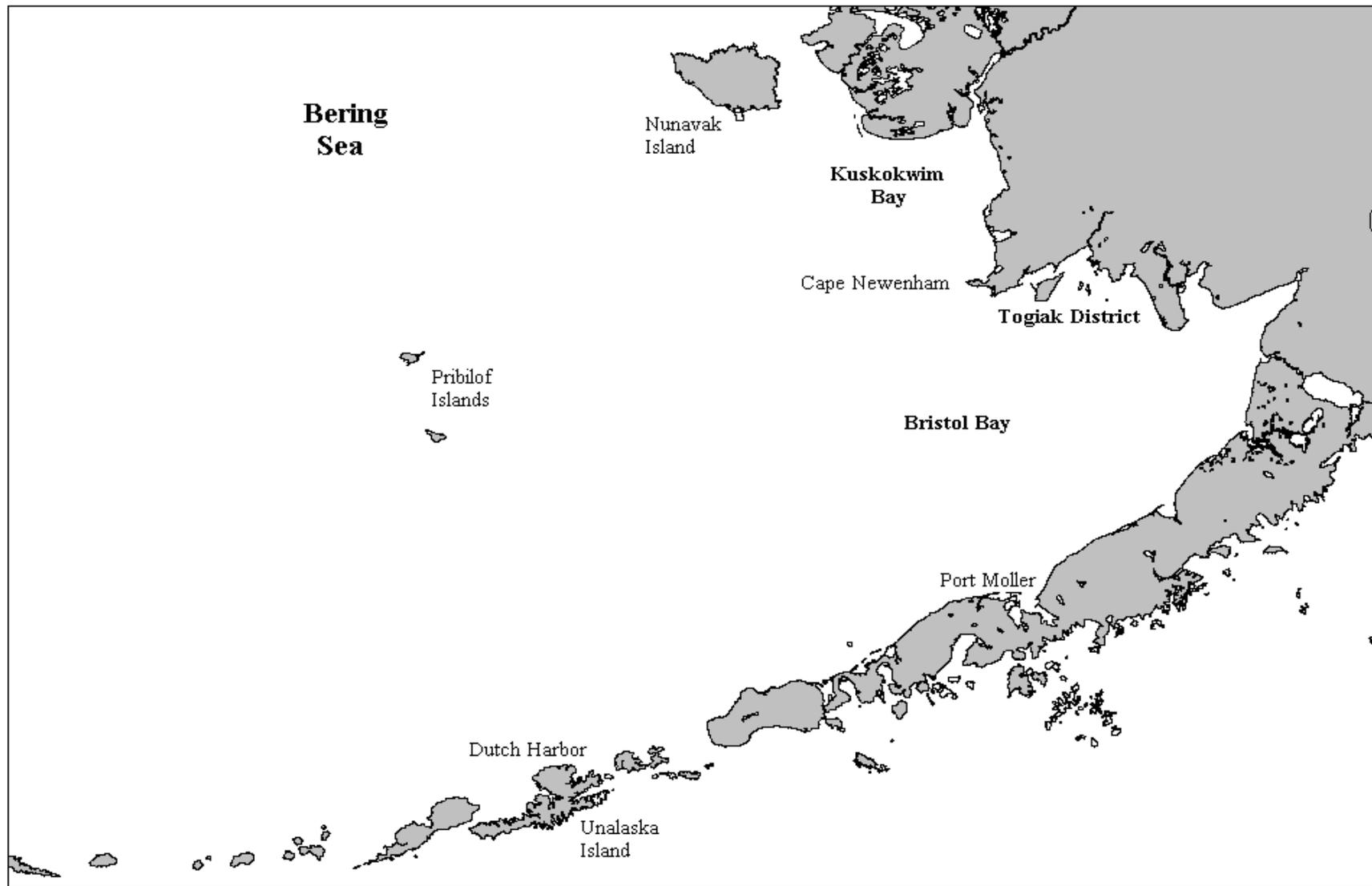


Figure 1.—Map of southeastern Bering Sea.

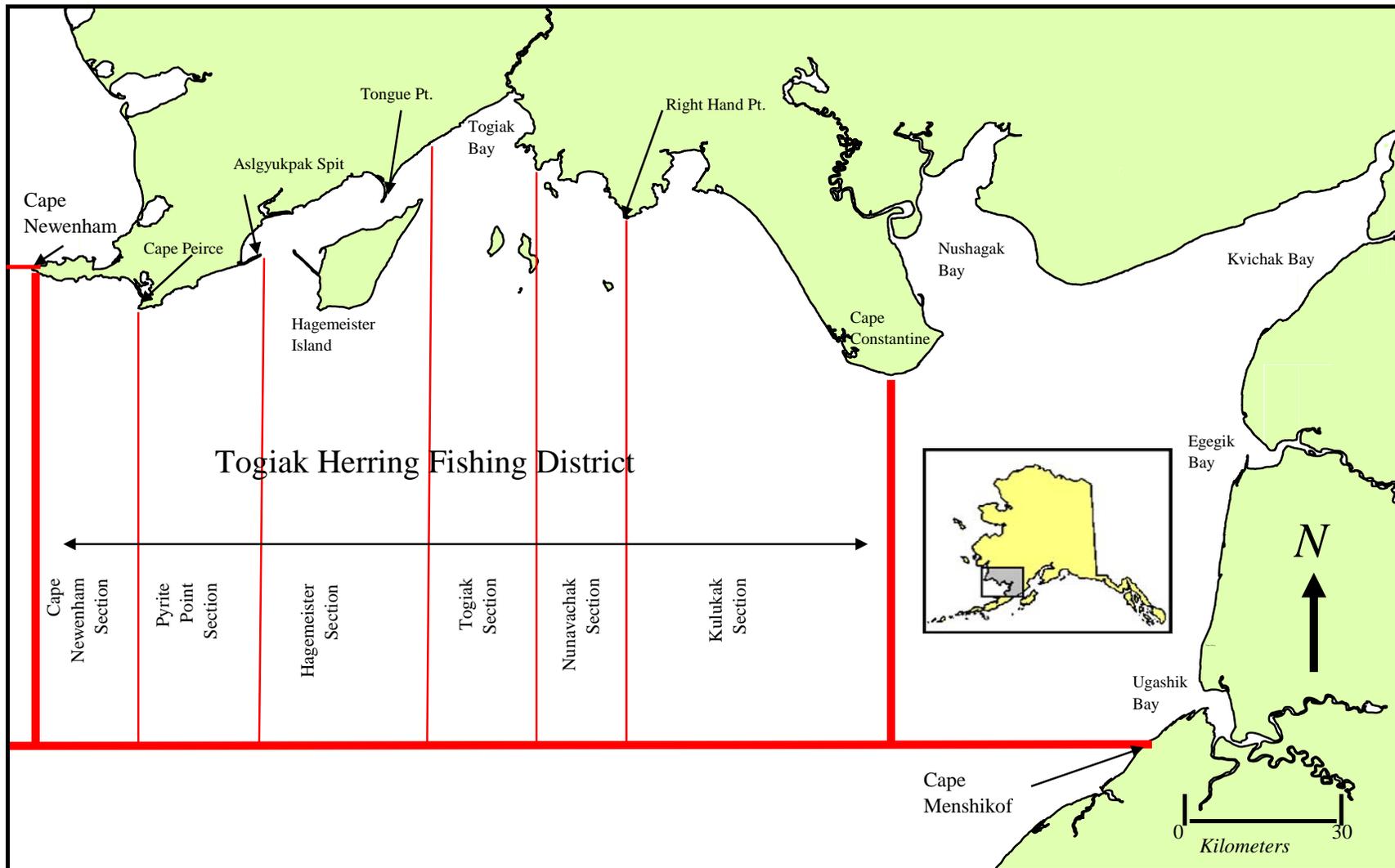


Figure 2.—Map of Togiak Herring District, Bristol Bay.

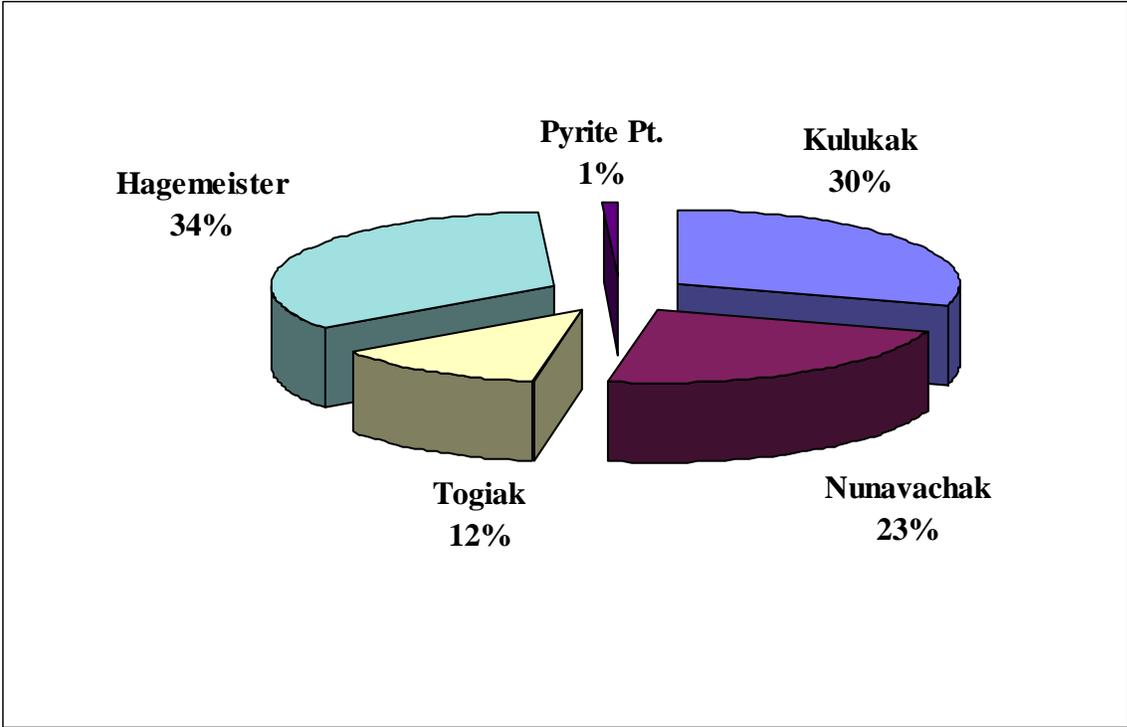


Figure 3.—Commercial harvest distribution by fishing section, Togiak District 2006.

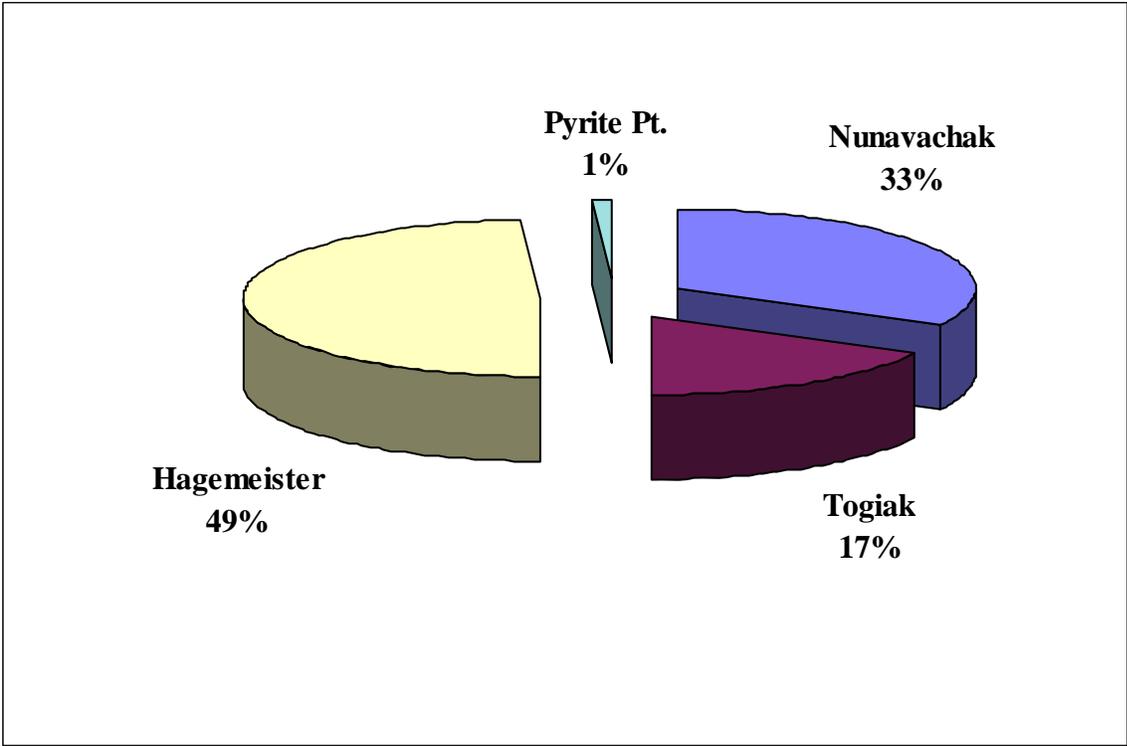


Figure 4.—Commercial purse seine harvest distribution by fishing section, Togiak District 2006.

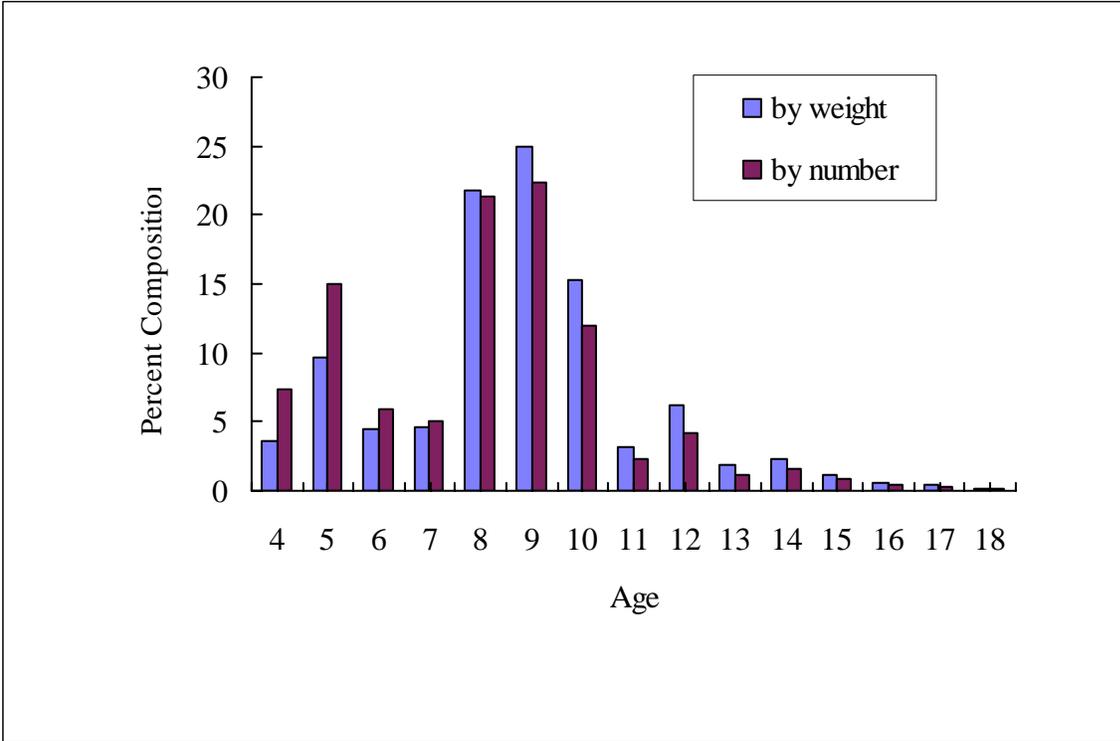


Figure 5.—Age composition of the total herring harvest, Togiak District, 2006.

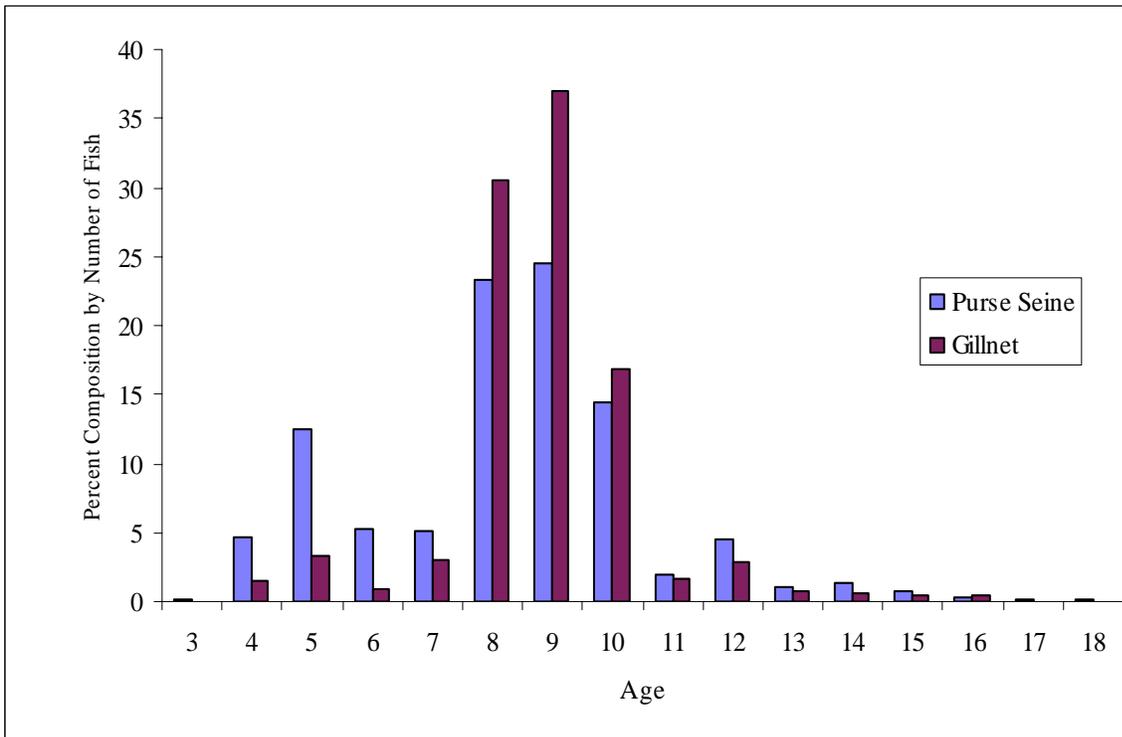
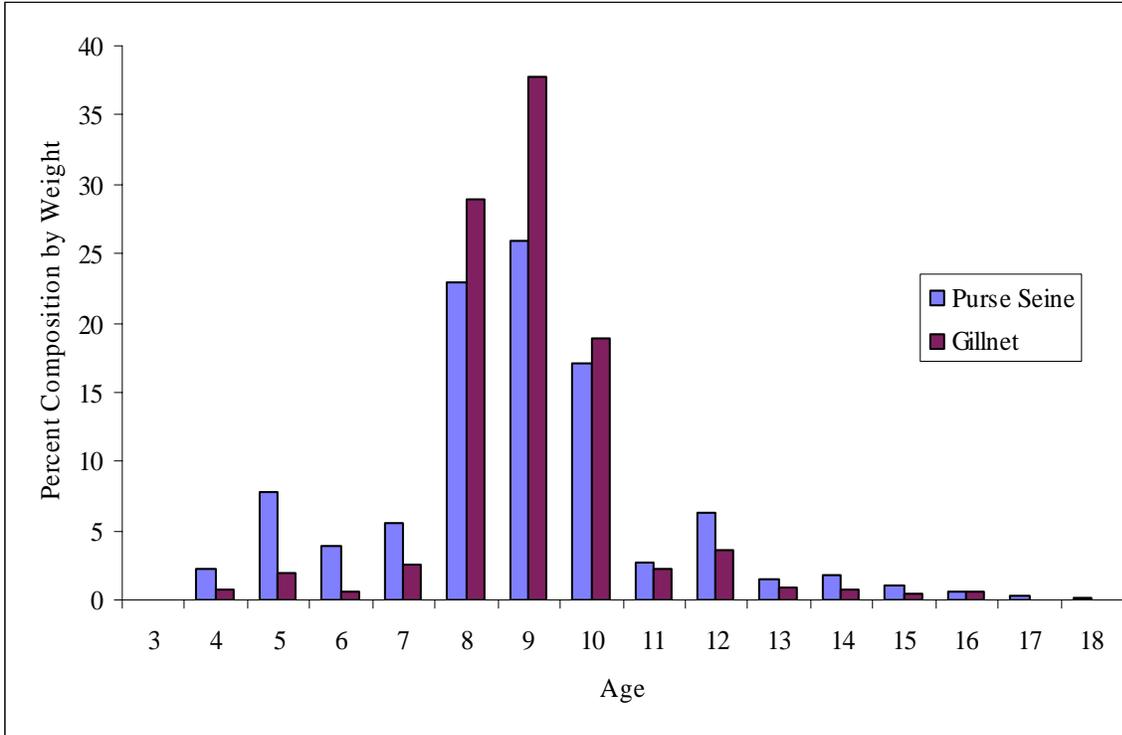
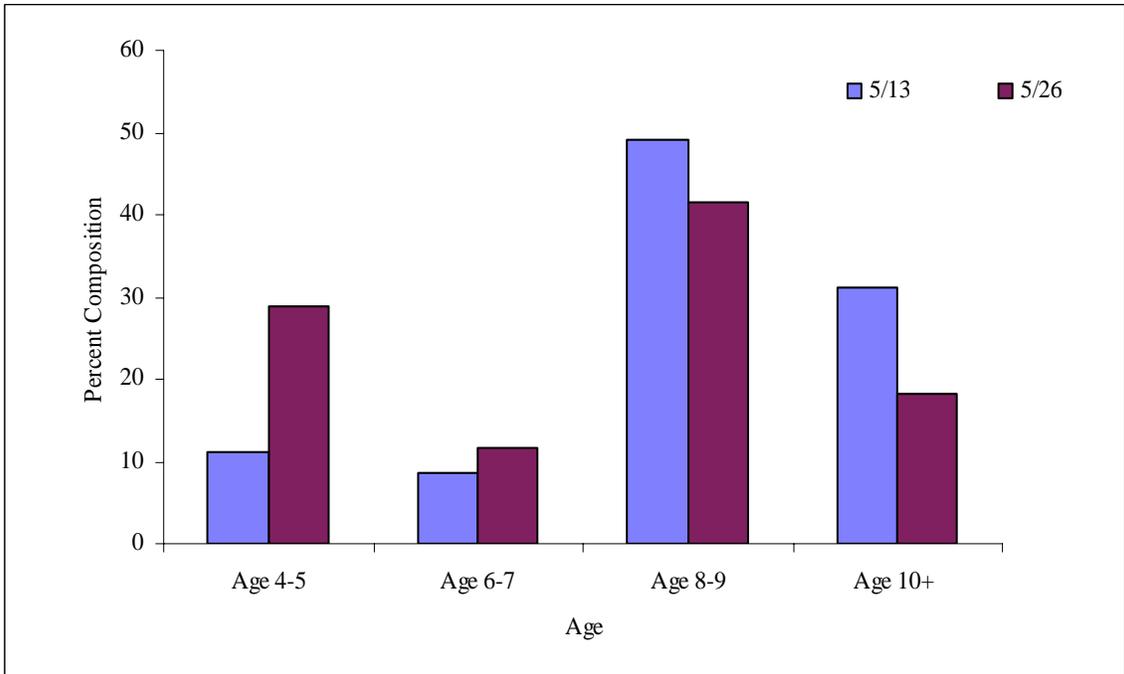
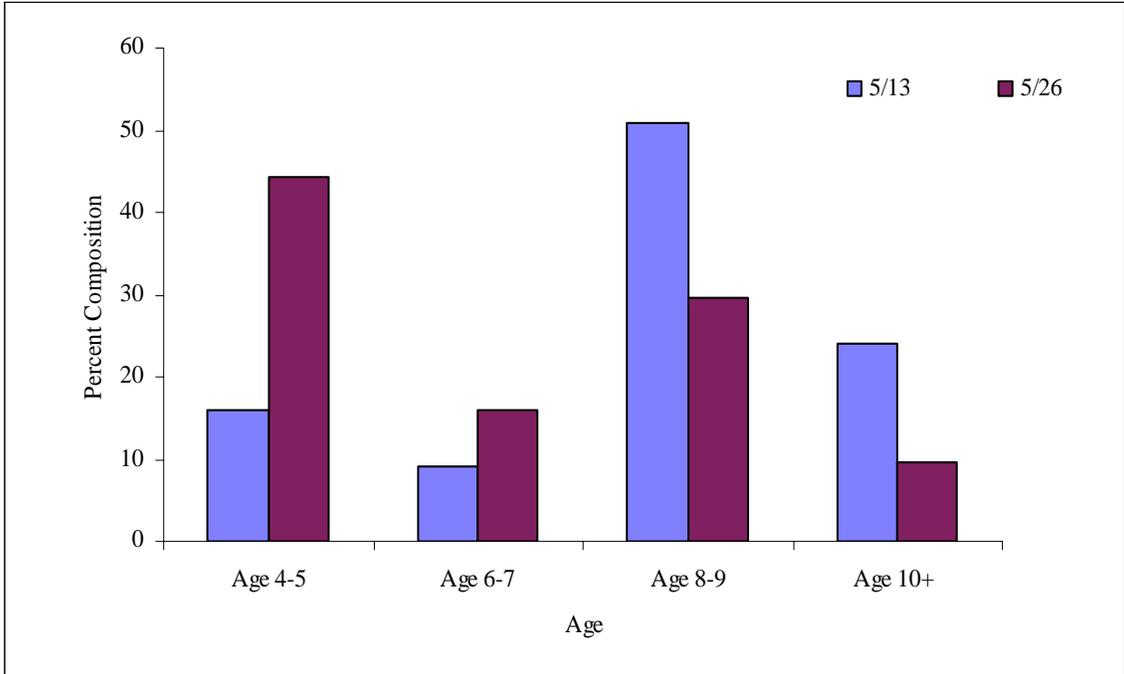
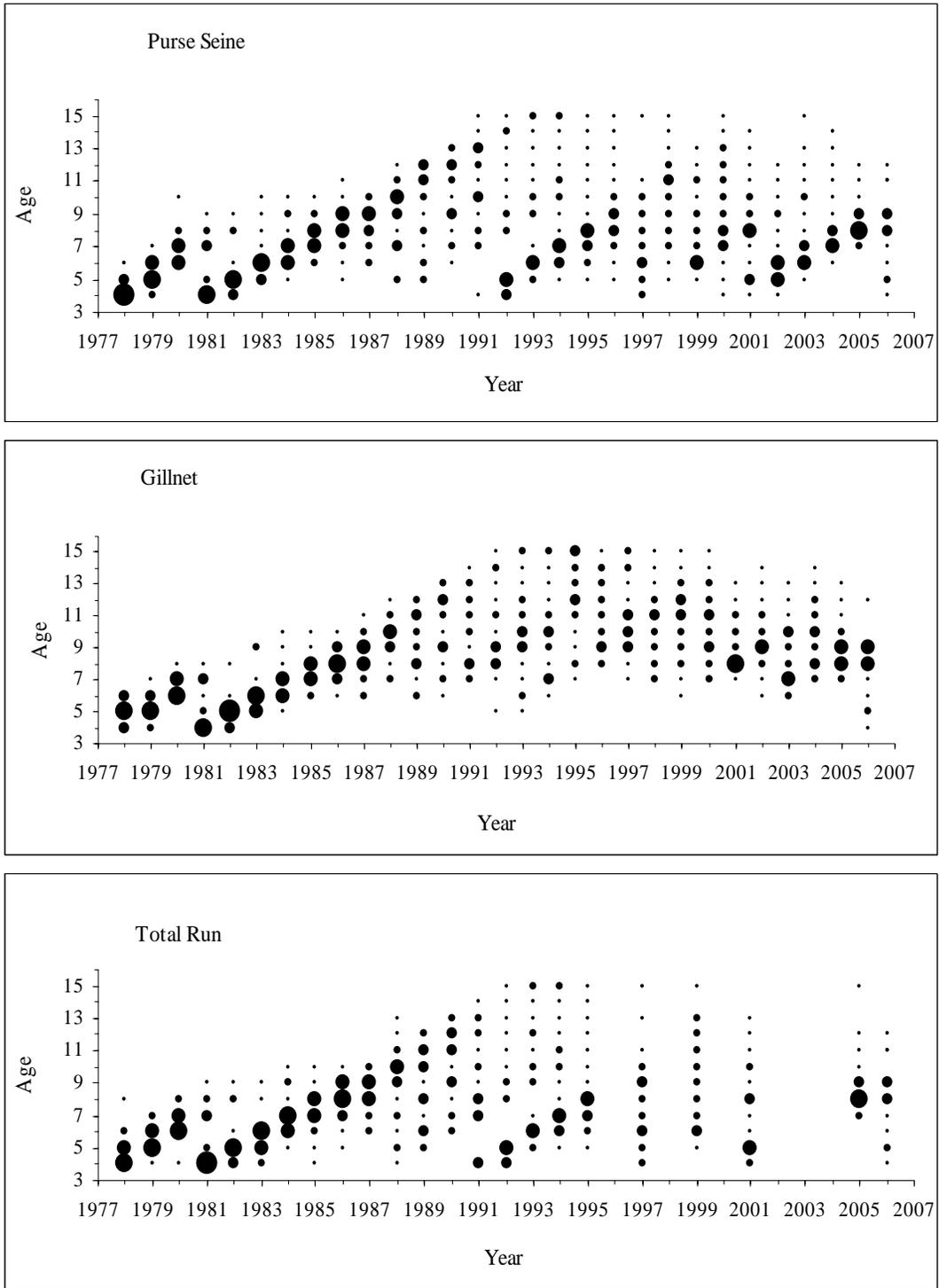


Figure 6.—Percent age composition of the commercial harvest by gear type for weight (top) and for numbers of fish (bottom), Togiak District, 2006.



Note: East Togiak District (Nunavachak and Togiak Sections (top)) and west Togiak District (Cape Newenham, Hagemeister and Pyrite Pt. Sections (bottom)).

Figure 7.—Age composition of herring samples collected with non-selective gear used to estimate the inseason peak biomass (13 May) and postseason peak biomass (26 May), 2006.



Note: the diameter of the circles represents percent age composition determined by number of fish.

Figure 8.—Historic age composition of the purse seine harvest, gillnet harvest and total run, Togiak District, Bristol Bay, 1977–2006.

APPENDIX A

Appendix A1.—Estimated age composition of the commercial purse seine harvest, by date and fishing section, Togiak District, 2006.

Sample Date(s): 5/12 Section(s): Hag, Nun, Tog Harvest biomass: 3,291.9 (tons)				Sample Date(s): 5/13 Section(s): Hag, Nun, Tog Harvest biomass: 2,499.3 (tons)				Sample Date(s): 5/14 Section(s): Hag, Nun, Tog Harvest biomass: 2,290.1 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	0	0.0	0	3	0	0.0	0	3	0	0.0	0
4	13	1.4	98	4	10	1.4	77	4	14	2.1	121
5	33	3.7	249	5	42	6.0	325	5	78	11.9	676
6	26	2.9	196	6	15	2.1	116	6	40	6.1	347
7	26	2.9	196	7	30	4.3	232	7	46	7.0	398
8	215	23.9	1,622	8	174	24.8	1,348	8	178	27.1	1,542
9	246	27.3	1,856	9	221	31.5	1,712	9	163	24.8	1,412
10	169	18.8	1,275	10	131	18.7	1,015	10	94	14.3	814
11	34	3.8	257	11	12	1.7	93	11	9	1.4	78
12	65	7.2	490	12	40	5.7	310	12	22	3.3	191
13	23	2.6	174	13	6	0.9	46	13	2	0.3	17
14	24	2.7	181	14	11	1.6	85	14	6	0.9	52
15	12	1.3	91	15	5	0.7	39	15	4	0.6	35
16	8	0.9	60	16	1	0.1	8	16	2	0.3	17
17	3	0.3	23	17	2	0.3	15	17	0	0.0	0
18	3	0.3	23	18	1	0.1	8	18	0	0.0	0
Total	900	100.0	6,790	Total	701	100.0	5,430	Total	658	100.0	5,700
Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	0	0.0	0	3	0	0.0	0	3	0	0.0	0
4	2,474	0.6	21	4	1,968	0.7	17	4	2,784	1.2	27
5	8,496	2.1	71	5	10,424	3.6	89	5	18,169	7.6	173
6	7,674	1.9	64	6	4,486	1.5	38	6	13,018	5.4	124
7	9,450	2.4	79	7	10,182	3.5	87	7	29,565	12.3	282
8	84,043	21.2	699	8	67,494	23.1	576	8	64,330	26.8	614
9	105,470	26.6	877	9	93,388	31.9	797	9	57,478	24.0	549
10	82,426	20.8	685	10	62,337	21.3	532	10	35,014	14.6	334
11	18,081	4.6	150	11	5,862	2.0	50	11	4,776	2.0	46
12	35,526	9.0	295	12	21,775	7.4	186	12	8,786	3.7	84
13	13,012	3.3	108	13	3,458	1.2	30	13	1,186	0.5	11
14	13,784	3.5	115	14	6,235	2.1	53	14	1,533	0.6	15
15	6,724	1.7	56	15	2,793	1.0	24	15	2,102	0.9	20
16	4,972	1.3	41	16	562	0.2	5	16	1,086	0.5	10
17	1,864	0.5	16	17	1,152	0.4	10	17	0	0.0	0
18	1,853	0.5	15	18	620	0.2	5	18	0	0.0	0
Total	395,849	100.0	3292	Total	292,736	100.0	2,499	Total	239,827	100.0	2,290

-continued-

Appendix A1.–Page 2 of 2.

Sample Date(s): 5/15 Section(s): Hag, Nun Harvest biomass: 1,003.0 (tons)				Sample Date(s): 5/17 - 5/20 Section(s): Hag, Nun, Pyp, Tog Harvest biomass: 7,737.0 (tons)				Sample Date(s): 5/12 - 5/20 Section(s): Harvest biomass: 16,821.3 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	1	0.2	4	3	3	0.3	69	3	4	0.1	73
4	30	5.2	129	4	109	11.6	2,506	4	176	4.7	2,932
5	75	13.1	322	5	242	25.7	5,564	5	470	12.5	7,137
6	32	5.6	138	6	83	8.8	1,908	6	196	5.2	2,705
7	40	7.0	172	7	49	5.2	1,127	7	191	5.1	2,126
8	133	23.3	572	8	178	18.9	4,093	8	878	23.3	9,176
9	144	25.2	619	9	151	16.0	3,472	9	925	24.5	9,070
10	74	12.9	318	10	74	7.9	1,701	10	542	14.4	5,123
11	8	1.4	34	11	12	1.3	276	11	75	2.0	738
12	23	4.0	99	12	23	2.4	529	12	173	4.6	1,618
13	5	0.9	21	13	4	0.4	92	13	40	1.1	351
14	2	0.3	9	14	9	1.0	207	14	52	1.4	534
15	3	0.5	13	15	3	0.3	69	15	27	0.7	246
16	0	0.0	0	16	2	0.2	46	16	13	0.3	131
17	2	0.3	9	17	0	0.0	0	17	7	0.2	47
18	0	0.0	0	18	0	0.0	0	18	4	0.1	30
Total	572	100.0	2,458	Total	942	100.0	21,659	Total	3,773	100.0	42,037
Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	221	0.1	1	3	696	0.2	18	3	917	0.1	19
4	5,664	2.7	27	4	20,591	6.7	522	4	33,481	2.3	613
5	18,573	8.8	88	5	57,406	18.8	1,455	5	113,068	7.8	1,876
6	8,913	4.2	42	6	22,873	7.5	580	6	56,964	3.9	848
7	13,331	6.3	63	7	16,793	5.5	426	7	79,321	5.5	937
8	49,158	23.2	233	8	66,275	21.7	1,680	8	331,300	22.9	3,802
9	58,398	27.6	277	9	60,129	19.7	1,524	9	374,863	25.9	4,024
10	34,584	16.3	164	10	33,360	10.9	845	10	247,721	17.1	2,561
11	3,944	1.9	19	11	5,994	2.0	152	11	38,657	2.7	417
12	12,502	5.9	59	12	11,698	3.8	296	12	90,287	6.2	921
13	2,497	1.2	12	13	2,395	0.8	61	13	22,548	1.6	222
14	1,114	0.5	5	14	4,346	1.4	110	14	27,012	1.9	298
15	1,575	0.7	7	15	1,509	0.5	38	15	14,703	1.0	146
16	0	0.0	0	16	1,206	0.4	31	16	7,826	0.5	87
17	1,229	0.6	6	17	0	0.0	0	17	4,245	0.3	31
18	0	0.0	0	18	0	0.0	0	18	2,473	0.2	21
Total	211,703	100.0	1,003	Total	305,271	100.0	7,737	Total	1,445,386	100.0	16,821

Appendix A2.—Estimated age composition of the commercial gillnet harvest, by date and fishing section, Togiak District, 2006.

Sample Dates: 5/13 - 5/14 Section(s): Kulukak Harvest biomass: 998.4 (tons)				Sample Dates: 5/15 - 5/16 Section(s): Kulukak Harvest biomass: 2,381.7 (tons)				Sample Dates: 5/17 - 5/21 Section(s): Kulukak Harvest biomass: 3,751.5 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)	Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	0	0.0	0	3	0	0.0	0	3	0	0.0	0
4	0	0.0	0	4	0	0.0	0	4	8	7.2	684
5	0	0.0	0	5	0	0.0	0	5	17	15.3	1,453
6	1	0.5	11	6	0	0.0	0	6	4	3.6	342
7	5	2.5	54	7	3	1.4	74	7	8	7.2	684
8	64	31.8	694	8	59	28.2	1,454	8	36	32.4	3,078
9	85	42.3	922	9	86	41.1	2,119	9	22	19.8	1,881
10	33	16.4	358	10	47	22.5	1,158	10	8	7.2	684
11	3	1.5	33	11	5	2.4	123	11	1	0.9	85
12	7	3.5	76	12	3	1.4	74	12	5	4.5	427
13	1	0.5	11	13	2	1.0	49	13	1	0.9	85
14	1	0.5	11	14	1	0.5	25	14	1	0.9	85
15	1	0.5	11	15	1	0.5	25	15	0	0.0	0
16	0	0.0	0	16	2	1.0	49	16	0	0.0	0
17	0	0.0	0	17	0	0.0	0	17	0	0.0	0
18	0	0.0	0	18	0	0.0	0	18	0	0.0	0
Total	201	100.0	2,179	Total	209	100.0	5,149	Total	111	100.0	9,490
Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)	Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0	0	1	0	0.0	0	1	0	0.0	0
2	0	0.0	0	2	0	0.0	0	2	0	0.0	0
3	0	0.0	0	3	0	0.0	0	3	0	0.0	0
4	0	0.0	0	4	0	0.0	0	4	1,696	4.3	160
5	0	0.0	0	5	0	0.0	0	5	4,029	10.1	380
6	355	0.4	4	6	0	0.0	0	6	1,052	2.6	99
7	1,865	2.2	22	7	1,089	1.2	30	7	2,576	6.5	243
8	24,796	29.7	296	8	22,554	25.7	612	8	13,644	34.3	1,286
9	34,795	41.7	416	9	35,690	40.7	969	9	9,108	22.9	858
10	15,062	18.0	180	10	21,131	24.1	574	10	3,712	9.3	350
11	1,546	1.9	18	11	2,531	2.9	69	11	547	1.4	52
12	3,592	4.3	43	12	1,475	1.7	40	12	2,415	6.1	228
13	519	0.6	6	13	960	1.1	26	13	415	1.0	39
14	532	0.6	6	14	502	0.6	14	14	615	1.5	58
15	470	0.6	6	15	576	0.7	16	15	0	0.0	0
16	0	0.0	0	16	1,196	1.4	32	16	0	0.0	0
17	0	0.0	0	17	0	0.0	0	17	0	0.0	0
18	0	0.0	0	18	0	0.0	0	18	0	0.0	0
Total	83,532	100.0	998	Total	87,704	100.0	2,382	Total	39,809	100.0	3,752

-continued-

Appendix A2.–Page 2 of 2.

Sample Dates: 5/13 - 5/21			
Section(s): Kulukak			
Harvest biomass: 7,131.6 (tons)			
Age	No. of Samples	Percent by No.	No. of fish (x1,000)
1	0	0.0	0
2	0	0.0	0
3	0	0.0	0
4	8	1.5	684
5	17	3.3	1,453
6	5	1.0	353
7	16	3.1	812
8	159	30.5	5,225
9	193	37.0	4,921
10	88	16.9	2,200
11	9	1.7	241
12	15	2.9	577
13	4	0.8	146
14	3	0.6	121
15	2	0.4	35
16	2	0.4	49
17	0	0.0	0
18	0	0.0	0
Total	521	100.0	16,818
Age	Weight	Percent by Weight	Biomass (tons)
1	0	0.0	0
2	0	0.0	0
3	0	0.0	0
4	1,696	0.8	160
5	4,029	1.9	380
6	1,407	0.7	103
7	5,530	2.6	295
8	60,994	28.9	2,195
9	79,593	37.7	2,243
10	39,905	18.9	1,104
11	4,624	2.2	139
12	7,482	3.5	311
13	1,894	0.9	71
14	1,649	0.8	78
15	1,046	0.5	21
16	1,196	0.6	32
17	0	0.0	0
18	0	0.0	0
Total	211,045	100.0	7,132

APPENDIX B

Appendix B1.—Age, sex and size composition of Pacific herring caught by commercial purse seine, Hagemeister Section, 12 May–18 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length		
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
12-May	7	0	1	0	1	0.6	0.6	460		1	293		1
	8	15	12	0	27	14.9	2.7	411	41.4	27	297	7.5	27
	9	14	18	0	32	17.7	2.8	453	42.0	32	305	7.0	32
	10	14	23	0	37	20.4	3.0	506	45.2	37	316	6.4	37
	11	3	11	0	14	7.7	2.0	552	40.4	14	324	8.2	14
	12	9	13	0	22	12.2	2.4	549	44.8	22	325	7.0	22
	13	5	13	0	18	9.9	2.2	575	58.9	18	329	7.8	18
	14	6	9	0	15	8.3	2.1	590	59.2	15	329	8.3	15
	15	4	3	0	7	3.9	1.4	570	74.6	7	328	12.8	7
	16	2	3	0	5	2.8	1.2	594	52.6	5	337	10.4	5
17	1	0	0	1	0.6	0.6	609		1	335		1	
18	1	1	0	2	1.1	0.8	618	87.7	2	341	13.4	2	
Sample Total		74	107	0	181	100.0		512	77.7	181	317	14.2	181
13-May	4	4	2	0	6	1.8	0.7	198	26.1	6	244	9.8	6
	5	14	12	0	26	7.8	1.5	252	30.6	26	260	6.1	26
	6	3	4	0	7	2.1	0.8	298	33.9	7	271	5.9	7
	7	10	8	0	18	5.4	1.2	341	31.7	18	283	5.8	18
	8	45	39	0	84	25.1	2.4	391	36.6	84	295	5.1	84
	9	48	53	0	101	30.1	2.5	428	39.2	101	304	5.0	101
	10	24	29	0	53	15.8	2.0	483	47.7	53	317	6.3	53
	11	4	1	0	5	1.5	0.7	506	22.1	5	326	4.3	5
	12	9	10	0	19	5.7	1.3	547	44.9	19	328	8.7	19
	13	1	1	0	2	0.6	0.4	583	32.5	2	330	9.9	2
14	5	4	0	9	2.7	0.9	551	24.7	9	332	4.8	9	
15	1	2	0	3	0.9	0.5	555	48.6	3	337	6.1	3	
16	0	1	0	1	0.3	0.3	562		1	345		1	
17													
18	0	1	0	1	0.3	0.3	620		1	355		1	
Sample Total		168	167	0	335	100.0		416	89.6	335	301	20.5	335
14-May	5	5	11	0	16	9.7	2.3	243	22.6	16	258	6.6	16
	6	9	4	0	13	7.9	2.1	292	30.1	13	273	8.0	13
	7	11	4	0	15	9.1	2.2	333	33.4	15	284	5.0	15
	8	30	15	0	45	27.3	3.5	374	36.9	45	295	5.3	45
	9	22	22	0	44	26.7	3.5	406	37.5	44	302	5.9	44
	10	9	13	0	22	13.3	2.7	449	45.5	22	314	4.7	22
	11	0	1	0	1	0.6	0.6	423		1	310		1
	12	4	0	0	4	2.4	1.2	500	48.6	4	324	3.6	4
	13	1	1	0	2	1.2	0.9	593	46.0	2	337	4.9	2
	14												
15	1	1	0	2	1.2	0.9	557	122.3	2	330	17.7	2	
16	0	1	0	1	0.6	0.6	504		1	334		1	
Sample Total		92	73	0	165	100.0		379	79.0	165	295	18.4	165

-continued-

Appendix B1.–Page 2 of 3.

Sample Dates	Age	Sex (number)				Percent		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
15-May	3	0	1	0	1	0.3	0.3	221		1	249		1	
	4	12	6	0	18	5.4	1.2	182	23.5	18	238	8.8	18	
	5	21	15	0	36	10.8	1.7	244	57.0	36	259	13.6	36	
	6	10	9	0	19	5.7	1.3	283	44.2	19	271	7.4	19	
	7	14	7	0	21	6.3	1.3	329	28.8	21	285	4.8	21	
	8	42	39	0	81	24.4	2.4	370	41.4	81	294	8.0	81	
	9	37	45	0	82	24.7	2.4	412	37.6	82	303	5.4	82	
	10	19	25	0	44	13.3	1.9	471	46.6	44	316	5.6	44	
	11	3	3	0	6	1.8	0.7	485	61.3	6	318	4.2	6	
	12	9	7	0	16	4.8	1.2	539	73.6	16	329	9.5	16	
	13	1	3	0	4	1.2	0.6	504	48.7	4	328	9.7	4	
	14	0	1	0	1	0.3	0.3	600		1	334		1	
	15	1	1	0	2	0.6	0.4	489	32.5	2	324	6.4	2	
	16													
	17	0	1	0	1	0.3	0.3	634		1	351		1	
	Sample Total		169	163	0	332	100.0		376	101.0	332	293	24.3	332
	17-May	4	20	12	0	32	11.9	2.0	187	32.7	32	239	12.7	32
5		40	22	0	62	23.0	2.6	234	27.7	62	257	8.1	62	
6		12	12	0	24	8.9	1.7	282	30.0	24	271	8.9	24	
7		7	6	0	13	4.8	1.3	339	52.0	13	284	5.8	13	
8		32	23	0	55	20.4	2.5	363	40.6	55	293	6.7	55	
9		29	18	0	47	17.5	2.3	387	50.5	47	302	9.8	47	
10		11	9	0	20	7.4	1.6	444	40.9	20	315	5.6	20	
11		2	3	0	5	1.9	0.8	467	56.1	5	322	2.3	5	
12		2	3	0	5	1.9	0.8	527	40.0	5	330	7.5	5	
13		1	0	0	1	0.4	0.4	520		1	326		1	
14		2	2	0	4	1.5	0.7	540	13.9	4	335	5.7	4	
15														
16	1	0	0	1	0.4	0.4	596		1	334		1		
Sample Total		159	110	0	269	100.0		323	100.5	269	281	27.5	269	
18-May	4	3	4	0	7	4.5	1.7	173	22.9	7	237	5.3	7	
	5	13	8	0	21	13.5	2.8	244	18.0	21	261	5.9	21	
	6	3	4	0	7	4.5	1.7	281	16.9	7	269	3.8	7	
	7	3	2	0	5	3.2	1.4	342	15.7	5	283	1.7	5	
	8	21	19	0	40	25.8	3.5	375	39.8	40	294	7.3	40	
	9	18	16	0	34	21.9	3.3	420	34.2	34	303	5.8	34	
	10	9	17	0	26	16.8	3.0	472	43.1	26	314	7.3	26	
	11	0	1	0	1	0.6	0.6	545		1	317		1	
	12	3	6	0	9	5.8	1.9	534	55.1	9	325	5.9	9	
	13	0	1	0	1	0.6	0.6	576		1	337		1	
	14	1	1	0	2	1.3	0.9	577	125.2	2	329	5.7	2	
15	0	1	0	1	0.6	0.6	603		1	333		1		
16	0	1	0	1	0.6	0.6	610		1	338		1		
Sample Total		74	81	0	155	100.0		386	104.8	155	294	23.7	155	

-continued-

Appendix B1.–Page 3 of 3.

Sample Dates	Age	Sex (number)				Percent		Weight			Length			
		Male	Female	Unk.	Total	of Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
12–18 May	3	0	1	0	1	0.1	0.1	221		1	249		1	
	4	39	24	0	63	4.4	0.5	185	28.8	63	239	10.8	63	
	5	93	68	0	161	11.2	0.8	241	35.8	161	258	9.1	161	
	6	37	33	0	70	4.9	0.6	286	33.6	70	271	7.5	70	
	7	45	28	0	73	5.1	0.6	337	37.2	73	284	5.2	73	
	8	185	147	0	332	23.1	1.1	379	41.3	332	294	6.7	332	
	9	168	172	0	340	23.7	1.1	417	43.6	340	303	6.4	340	
	10	86	116	0	202	14.1	0.9	476	48.9	202	316	6.2	202	
	11	12	20	0	32	2.2	0.4	515	56.9	32	322	6.8	32	
	12	36	39	0	75	5.2	0.6	541	53.0	75	327	7.8	75	
	13	9	19	0	28	1.9	0.4	564	57.8	28	329	7.8	28	
	14	14	17	0	31	2.2	0.4	572	52.8	31	331	6.9	31	
	15	7	8	0	15	1.0	0.3	557	69.1	15	330	10.9	15	
	16	3	6	0	9	0.6	0.2	583	49.1	9	337	8.0	9	
	17	1	1	0	2	0.1	0.1	622	17.7	2	343	11.3	2	
	18	1	2	0	3	0.2	0.1	619	62.0	3	345	12.7	3	
	All Samples Combined		736	701	0	1,437	100.0		394	108.0	1,437	296	24.6	1,437
	Sex Composition		51.2	48.8										
Unaged		92	103	0	195	13.6		418	108.6	194	303	24.4	195	
Sex Composition		47.2	52.8											

Appendix B2.—Age, sex and size composition of Pacific herring caught by commercial purse seine, Nunavachack Section, 12 May–19 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight		Length				
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
12-May	4	1	1	0	2	0.6	0.4	203	39.6	2	246	13.4	2	
	5	4	1	0	5	1.4	0.6	260	27.7	5	263	5.9	5	
	6	5	3	0	8	2.3	0.8	327	46.2	8	280	7.0	8	
	7	6	1	0	7	2.0	0.7	374	28.8	7	290	6.3	7	
	8	50	43	0	93	26.3	2.3	387	40.4	93	295	7.2	93	
	9	57	56	0	113	32.0	2.5	427	42.6	113	304	7.3	113	
	10	39	37	0	76	21.5	2.2	486	49.8	76	317	9.2	76	
	11	4	5	0	9	2.5	0.8	527	63.7	9	324	11.3	9	
	12	9	14	0	23	6.5	1.3	536	44.4	23	328	6.8	23	
	13	2	2	0	4	1.1	0.6	546	47.6	4	337	9.9	4	
	14	4	1	0	5	1.4	0.6	558	57.5	5	330	6.6	5	
	15	2	2	0	4	1.1	0.6	554	66.3	4	335	13.3	4	
	16	0	2	0	2	0.6	0.4	659	65.1	2	345	0.0	2	
	17	0	1	0	1	0.3	0.3	611		1	328		1	
	18	0	1	0	1	0.3	0.3	617		1	338		1	
	Sample Total		183	170	0	353	100.0		439	77.6	353	307	16.3	353
	13-May	4	2	2	0	4	1.1	0.5	195	22.8	4	244	3.7	4
		5	10	6	0	16	4.4	1.1	242	29.1	16	258	9.0	16
6		3	5	0	8	2.2	0.8	300	21.2	8	274	5.7	8	
7		8	4	0	12	3.3	0.9	337	37.1	12	283	7.9	12	
8		52	38	0	90	24.6	2.3	385	39.5	90	295	6.9	90	
9		56	64	0	120	32.8	2.5	418	46.3	120	304	6.8	120	
10		32	46	0	78	21.3	2.1	471	38.8	78	316	5.4	78	
11		5	2	0	7	1.9	0.7	476	47.3	7	321	6.2	7	
12		9	12	0	21	5.7	1.2	542	48.3	21	327	7.9	21	
13		1	3	0	4	1.1	0.5	573	46.6	4	332	13.4	4	
14		0	2	0	2	0.5	0.4	638	29.7	2	337	2.1	2	
15		1	1	0	2	0.5	0.4	564	33.9	2	339	2.1	2	
16														
17		1	1	0	2	0.5	0.4	576	62.9	2	337	1.4	2	
Sample Total		180	186	0	366	100.0		419	81.9	366	303	18.0	366	
14-May		4	4	6	0	10	3.1	1.0	198	26.3	10	240	11.3	10
		5	12	38	0	50	15.6	2.0	239	25.2	50	256	8.8	50
	6	9	9	0	18	5.6	1.3	275	39.1	18	266	8.8	18	
	7	12	3	0	15	4.7	1.2	338	24.9	15	286	4.3	15	
	8	42	39	0	81	25.3	2.4	378	36.7	81	294	7.2	81	
	9	31	42	0	73	22.8	2.3	420	42.4	73	304	6.1	73	
	10	23	27	0	50	15.6	2.0	466	37.5	50	313	5.1	50	
	11	2	2	0	4	1.3	0.6	482	96.7	4	321	7.9	4	
	12	8	5	0	13	4.1	1.1	522	44.5	13	325	6.4	13	
	13													
	14	2	1	0	3	0.9	0.5	511	74.4	3	330	4.9	3	
	15	0	2	0	2	0.6	0.4	494	25.5	2	335	2.8	2	
	16	0	1	0	1	0.3	0.3	582		1	342		1	
	Sample Total		145	175	0	320	100.0		376	95.2	320	292	23.8	320

-continued-

Appendix B2.–Page 2 of 2.

Sample Dates	Age	Sex (number)				Percent		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
15-May	4	7	5	0	12	5.0	1.4	199	19.9	12	245	8.7	12	
	5	16	23	0	39	16.3	2.4	251	27.1	39	262	7.3	39	
	6	7	6	0	13	5.4	1.5	272	25.5	13	270	6.2	13	
	7	7	12	0	19	7.9	1.7	338	34.7	19	285	6.6	19	
	8	29	23	0	52	21.7	2.7	369	36.1	52	295	6.2	52	
	9	32	30	0	62	25.8	2.8	397	31.0	62	303	5.3	62	
	10	9	21	0	30	12.5	2.1	462	43.2	30	316	6.0	30	
	11	0	2	0	2	0.8	0.6	517	37.5	2	321	1.4	2	
	12	3	4	0	7	2.9	1.1	554	62.7	7	328	5.6	7	
	13	1	0	0	1	0.4	0.4	481		1	333		1	
	14	0	1	0	1	0.4	0.4	514		1	331		1	
	15	0	1	0	1	0.4	0.4	597		1	334		1	
	16													
	17	0	1	0	1	0.4	0.4	595		1	337		1	
	Sample Total		111	129	0	240	100.0		362	91.7	240	292	22.3	240
	19-May	4	10	9	0	19	10.6	2.3	187	29.3	19	239	10.4	19
		5	33	35	0	68	38.0	3.6	237	26.1	68	258	6.5	68
6		10	12	0	22	12.3	2.5	269	30.4	22	269	7.0	22	
7		7	2	0	9	5.0	1.6	338	30.1	9	284	6.1	9	
8		20	13	0	33	18.4	2.9	370	37.7	33	294	6.6	33	
9		10	10	0	20	11.2	2.4	393	27.8	20	298	5.5	20	
10		2	2	0	4	2.2	1.1	442	41.4	4	316	6.2	4	
11		1	1	0	2	1.1	0.8	481	2.8	2	321	4.2	2	
12		1	0	0	1	0.6	0.6	449		1	327		1	
13		0	1	0	1	0.6	0.6	678		1	350		1	
Sample Total			94	85	0	179	100.0		294	86.6	179	273	23.0	179
12–19 May		4	24	23	0	47	3.2	0.5	194	25.8	47	242	9.9	47
		5	75	103	0	178	12.2	0.9	242	26.8	178	259	7.9	178
	6	34	35	0	69	4.7	0.6	282	37.6	69	270	8.2	69	
	7	40	22	0	62	4.3	0.5	342	32.9	62	285	6.5	62	
	8	193	156	0	349	23.9	1.1	380	38.9	349	295	6.9	349	
	9	186	202	0	388	26.6	1.2	417	42.9	388	304	6.6	388	
	10	105	133	0	238	16.3	1.0	473	43.7	238	316	7.0	238	
	11	12	12	0	24	1.6	0.3	500	62.1	24	322	8.1	24	
	12	30	35	0	65	4.5	0.5	535	48.5	65	327	6.9	65	
	13	4	6	0	10	0.7	0.2	564	62.2	10	336	11.1	10	
	14	6	5	0	11	0.8	0.2	556	68.3	11	331	5.5	11	
	15	3	6	0	9	0.6	0.2	548	54.6	9	336	8.4	9	
	16	0	3	0	3	0.2	0.1	633	64	3	344	1.7	3	
	17	1	3	0	4	0.3	0.1	589	40.2	4	335	4.6	4	
	18	0	1	0	1	0.1	0.1	617		1	338		1	
	All Samples Combined		713	745	0	1,458	100.0		390	97.5	1,458	296	23.0	1,458
	Sex Composition		48.9	51.1										
	Unaged		79	82	0	161	11.0		409	92.0	161	301	20.8	161
Sex Composition		49.1	50.9											

Appendix B3.—Age, sex and size composition of Pacific herring caught by commercial purse seine, Togiak Section, 12 May–18 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
12-May	4	6	5	0	11	3.0	0.9	188	24.9	11	240	7.0	11	
	5	9	19	0	28	7.7	1.4	257	30.0	28	260	7.8	28	
	6	12	6	0	18	4.9	1.1	281	30.2	18	271	7.5	18	
	7	11	7	0	18	4.9	1.1	354	43.4	18	287	8.3	18	
	8	51	44	0	95	26.0	2.3	389	39.2	95	294	6.9	95	
	9	52	49	0	101	27.6	2.3	423	42.7	101	303	7.6	101	
	10	24	32	0	56	15.3	1.9	478	44.2	56	316	6.1	56	
	11	4	7	0	11	3.0	0.9	510	47.2	11	320	7.1	11	
	12	8	12	0	20	5.5	1.2	556	56.3	20	332	5.2	20	
	13	1	0	0	1	0.3	0.3	478		1	320		1	
	14	4	0	0	4	1.1	0.5	536	77.1	4	339	9.5	4	
	15	1	0	0	1	0.3	0.3	518		1	318		1	
	16	0	1	0	1	0.3	0.3	684		1	350		1	
	17	0	1	0	1	0.3	0.3	644		1	339		1	
	Sample Total		183	183	0	366	100.0		405	94.0	366	298	21.8	366
	14-May	4	2	2	0	4	2.3	1.1	201	36.7	4	244	11.6	4
		5	7	5	0	12	6.9	1.9	259	18.9	12	264	8.6	12
6		5	4	0	9	5.2	1.7	267	41.2	9	267	11.5	9	
7		7	9	0	16	9.2	2.2	375	46.5	16	292	10.1	16	
8		25	27	0	52	30.1	3.5	367	34.3	52	293	6.1	52	
9		17	29	0	46	26.6	3.4	407	43.3	46	303	8.0	46	
10		10	12	0	22	12.7	2.5	459	39.0	22	315	5.3	22	
11		2	2	0	4	2.3	1.1	485	48.0	4	321	5.0	4	
12		2	3	0	5	2.9	1.3	537	49.0	5	328	2.5	5	
13														
14	2	1	0	3	1.7	1.0	536	42.1	3	332	5.7	3		
Sample Total		79	94	0	173	100.0		384	79.5	173	296	19.0	173	
18-May	3	1	2	0	3	0.9	0.5	232	61.0	3	254	13.7	3	
	4	24	27	0	51	15.0	1.9	193	22.1	51	241	8.0	51	
	5	40	51	0	91	26.8	2.4	238	29.4	91	258	7.9	91	
	6	10	20	0	30	8.8	1.5	274	34.1	30	268	8.4	30	
	7	10	12	0	22	6.5	1.3	347	43.6	22	289	11.5	22	
	8	31	19	0	50	14.7	1.9	382	33.9	50	296	6.4	50	
	9	30	20	0	50	14.7	1.9	396	47.5	50	303	7.9	50	
	10	9	15	0	24	7.1	1.4	435	63.9	24	313	6.9	24	
	11	2	2	0	4	1.2	0.6	538	48.6	4	325	6.1	4	
	12	6	2	0	8	2.4	0.8	476	73.2	8	330	7.3	8	
	13	0	1	0	1	0.3	0.3	621		1	340		1	
	14	3	0	0	3	0.9	0.5	344	140.9	3	294	47.3	3	
	15	2	0	0	2	0.6	0.4	453	24.7	2	333	1.4	2	
	Sample Total		168	171	0	339	100.0		313	99.7	339	278	27.6	339

-continued-

Appendix B3.–Page 2 of 2.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
12–18 May	3	1	2	0	3	0.3	0.2	232	61.0	3	254	13.7	3	
	4	32	34	0	66	7.5	0.9	192	23.3	66	241	8.0	66	
	5	56	75	0	131	14.9	1.2	244	29.9	131	259	8.1	131	
	6	27	30	0	57	6.5	0.8	275	33.8	57	269	8.6	57	
	7	28	28	0	56	6.4	0.8	357	45.1	56	289	10.2	56	
	8	107	90	0	197	22.4	1.4	382	37.6	197	294	6.7	197	
	9	99	98	0	197	22.4	1.4	412	45.4	197	303	7.7	197	
	10	43	59	0	102	11.6	1.1	464	51.1	102	315	6.1	102	
	11	8	11	0	19	2.2	0.5	511	48.2	19	321	6.6	19	
	12	16	17	0	33	3.8	0.6	534	67.1	33	331	5.6	33	
	13	1	1	0	2	0.2	0.2	550	101.1	2	330	14.1	2	
	14	9	1	0	10	1.1	0.4	478	124.1	10	324	31.1	10	
	15	3	0	0	3	0.3	0.2	474	41.7	3	328	8.7	3	
	16	0	1	0	1	0.1	0.1	684		1	350		1	
	17	0	1	0	1	0.1	0.1	644		1	339		1	
	All Samples Combined		430	448	0	878	100.0		365	102.8	878	290	25.5	878
	Sex Composition		49.0	51.0										
Unaged		49	53	0	102	11.6		375	104.5	102	293	25.1	102	
Sex Composition		48.0	52.0											

Appendix B4.—Age, sex and size composition of Pacific herring caught by commercial purse seine, Hagemeister, Nunavachak, and Togiak Sections, 12 May–19 May 2006.

Sample Dates	Age	Sex (number)			Total	Percent of		Weight			Length			
		Male	Female	Unk.		Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
12-May	4	7	6	0	13	1.4	0.4	190	26.1	13	241	7.8	13	
	5	13	20	0	33	3.7	0.6	257	29.3	33	261	7.5	33	
	6	17	9	0	26	2.9	0.6	295	41.1	26	274	8.5	26	
	7	17	9	0	26	2.9	0.6	363	44.3	26	288	7.8	26	
	8	116	99	0	215	23.9	1.4	391	40.5	215	295	7.1	215	
	9	123	123	0	246	27.3	1.5	429	43.5	246	304	7.4	246	
	10	77	92	0	169	18.8	1.3	488	48.0	169	316	7.7	169	
	11	11	23	0	34	3.8	0.6	532	51.3	34	322	8.7	34	
	12	26	39	0	65	7.2	0.9	547	48.5	65	328	6.9	65	
	13	8	15	0	23	2.6	0.5	565	58.9	23	330	8.6	23	
	14	14	10	0	24	2.7	0.5	574	62.9	24	331	8.7	24	
	15	7	5	0	12	1.3	0.4	561	66.9	12	330	12.7	12	
	16	2	6	0	8	0.9	0.3	622	60.6	8	341	9.4	8	
	17	1	2	0	3	0.3	0.2	621	19.7	3	334	5.6	3	
	18	1	2	0	3	0.3	0.2	618	62.0	3	340	9.6	3	
	Sample Total		440	460	0	900	100.0		440	93.2	900	305	19.6	900
	13-May	4	6	4	0	10	1.4	0.4	197	23.6	10	244	7.6	10
		5	24	18	0	42	6.0	0.9	248	30.1	42	259	7.3	42
6		6	9	0	15	2.1	0.5	299	26.8	15	272	5.8	15	
7		18	12	0	30	4.3	0.8	339	33.4	30	283	6.6	30	
8		97	77	0	174	24.8	1.6	388	38.2	174	295	6.1	174	
9		104	117	0	221	31.5	1.8	423	43.3	221	304	6.0	221	
10		56	75	0	131	18.7	1.5	476	42.9	131	316	5.9	131	
11		9	3	0	12	1.7	0.5	489	40.3	12	323	5.7	12	
12		18	22	0	40	5.7	0.9	544	46.2	40	327	8.2	40	
13		2	4	0	6	0.9	0.4	576	39.2	6	331	11.3	6	
14		5	6	0	11	1.6	0.5	567	42.6	11	333	4.8	11	
15		2	3	0	5	0.7	0.3	559	38.6	5	338	4.5	5	
16		0	1	0	1	0.1	0.1	562		1	345		1	
17		1	1	0	2	0.3	0.2	576	62.9	2	337	1.4	2	
18		0	1	0	1	0.1	0.1	620		1	355		1	
Sample Total		348	353	0	701	100.0		418	85.7	701	302	19.3	701	
14-May		4	6	8	0	14	2.1	0.6	199	28.1	14	241	11.2	14
		5	24	54	0	78	11.9	1.3	243	24.7	78	258	8.7	78
	6	23	17	0	40	6.1	0.9	279	37.3	40	269	9.5	40	
	7	30	16	0	46	7.0	1.0	349	40.4	46	287	7.7	46	
	8	97	81	0	178	27.1	1.7	374	36.1	178	294	6.5	178	
	9	70	93	0	163	24.8	1.7	413	41.7	163	303	6.7	163	
	10	42	52	0	94	14.3	1.4	460	40.0	94	314	5.1	94	
	11	4	5	0	9	1.4	0.5	477	69.1	9	320	6.7	9	
	12	14	8	0	22	3.3	0.7	521	45.5	22	325	5.3	22	
	13	1	1	0	2	0.3	0.2	593	46.0	2	337	4.9	2	
	14	4	2	0	6	0.9	0.4	523	55.8	6	331	4.9	6	
	15	1	3	0	4	0.6	0.3	525	80.7	4	332	10.8	4	
	16	0	2	0	2	0.3	0.2	543	55.2	2	338	5.7	2	
	Sample Total		316	342	0	658	100.0		379	87.3	658	294	21.4	658

-continued-

Appendix B4.–Page 2 of 3.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
15-May	3	0	1	0	1	0.2	0.2	221		1	249		1	
	4	19	11	0	30	5.2	0.9	189	23.4	30	241	9.4	30	
	5	37	38	0	75	13.1	1.4	248	43.9	75	261	10.9	75	
	6	17	15	0	32	5.6	1.0	278	37.7	32	270	6.8	32	
	7	21	19	0	40	7.0	1.1	333	31.7	40	285	5.7	40	
	8	71	62	0	133	23.3	1.8	370	39.3	133	294	7.4	133	
	9	69	75	0	144	25.2	1.8	405	35.5	144	303	5.3	144	
	10	28	46	0	74	12.9	1.4	467	45.2	74	316	5.7	74	
	11	3	5	0	8	1.4	0.5	493	55.6	8	318	3.9	8	
	12	12	11	0	23	4.0	0.8	544	69.3	23	328	8.4	23	
	13	2	3	0	5	0.9	0.4	499	43.4	5	329	8.7	5	
	14	0	2	0	2	0.3	0.2	557	60.8	2	333	2.1	2	
	15	1	2	0	3	0.5	0.3	525	66.5	3	327	7.5	3	
	16													
	17	0	2	0	2	0.3	0.2	615	27.6	2	344	9.9	2	
	Sample Total		280	292	0	572	100.0		370	97.3	572	293	23.5	572
	17-May	4	20	12	0	32	11.9	2.0	187	32.7	32	239	12.7	32
5		40	22	0	62	23.0	2.6	234	27.7	62	257	8.1	62	
6		12	12	0	24	8.9	1.7	282	30.0	24	271	8.9	24	
7		7	6	0	13	4.8	1.3	339	52.0	13	284	5.8	13	
8		32	23	0	55	20.4	2.5	363	40.6	55	293	6.7	55	
9		29	18	0	47	17.5	2.3	387	50.5	47	302	9.8	47	
10		11	9	0	20	7.4	1.6	444	40.9	20	315	5.6	20	
11		2	3	0	5	1.9	0.8	467	56.1	5	322	2.3	5	
12		2	3	0	5	1.9	0.8	527	40.0	5	330	7.5	5	
13		1	0	0	1	0.4	0.4	520		1	326		1	
14		2	2	0	4	1.5	0.7	540	13.9	4	335	5.7	4	
15														
16	1	0	0	1	0.4	0.4	596		1	334		1		
Sample Total		159	110	0	269	100.0		323	100.5	269	281	27.5	269	
18-May	3	1	2	0	3	0.6	0.3	232	61.0	3	254	13.7	3	
	4	27	31	0	58	11.7	1.4	190	22.9	58	241	7.8	58	
	5	53	59	0	112	22.7	1.9	239	27.7	112	258	7.7	112	
	6	13	24	0	37	7.5	1.2	275	31.4	37	268	7.7	37	
	7	13	14	0	27	5.5	1.0	346	39.7	27	288	10.6	27	
	8	52	38	0	90	18.2	1.7	379	36.6	90	295	6.8	90	
	9	48	36	0	84	17.0	1.7	406	44.0	84	303	7.1	84	
	10	18	32	0	50	10.1	1.4	455	56.6	50	313	7.0	50	
	11	2	3	0	5	1.0	0.4	539	42.2	5	324	6.5	5	
	12	9	8	0	17	3.4	0.8	507	69.1	17	327	6.9	17	
	13	0	2	0	2	0.4	0.3	599	31.8	2	339	2.1	2	
	14	4	1	0	5	1.0	0.4	437	173.5	5	308	38.8	5	
	15	2	1	0	3	0.6	0.3	503	88.6	3	333	1.0	3	
	16	0	1	0	1	0.2	0.2	610		1	338		1	
	Sample Total		242	252	0	494	100.0		336	106.9	494	283	27.5	494

-continued-

Appendix B4.–Page 3 of 3.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
19-May	4	10	9	0	19	10.6	2.3	187	29.3	19	239	10.4	19	
	5	33	35	0	68	38.0	3.6	237	26.1	68	258	6.5	68	
	6	10	12	0	22	12.3	2.5	269	30.4	22	269	7.0	22	
	7	7	2	0	9	5.0	1.6	338	30.1	9	284	6.1	9	
	8	20	13	0	33	18.4	2.9	370	37.7	33	294	6.6	33	
	9	10	10	0	20	11.2	2.4	393	27.8	20	298	5.5	20	
	10	2	2	0	4	2.2	1.1	442	41.4	4	316	6.2	4	
	11	1	1	0	2	1.1	0.8	481	2.8	2	321	4.2	2	
	12	1	0	0	1	0.6	0.6	449		1	327		1	
	13	0	1	0	1	0.6	0.6	678		1	350		1	
	Sample Total		94	85	0	179	100.0		294	86.6	179	273	23.0	179
	12–19 May	3	1	3	0	4	0.1	0.1	230	50.1	4	253	11.5	4
		4	95	81	0	176	4.7	0.3	190	26.2	176	241	9.6	176
5		224	246	0	470	12.5	0.5	242	31.0	470	258	8.4	470	
6		98	98	0	196	5.2	0.4	281	35.2	196	270	8.1	196	
7		113	78	0	191	5.1	0.4	345	39.2	191	286	7.6	191	
8		485	393	0	878	23.3	0.7	380	39.5	878	295	6.8	878	
9		453	472	0	925	24.5	0.7	416	43.7	925	303	6.8	925	
10		234	308	0	542	14.4	0.6	472	47.3	542	316	6.5	542	
11		32	43	0	75	2.0	0.2	509	56.2	75	322	7.1	75	
12		82	91	0	173	4.6	0.3	537	54.1	173	328	7.3	173	
13		14	26	0	40	1.1	0.2	563	59.0	40	331	9.1	40	
14		29	23	0	52	1.4	0.2	550	81.1	52	330	14.6	52	
15		13	14	0	27	0.7	0.1	545	65.4	27	332	10.1	27	
16		3	10	0	13	0.3	0.1	602	58.1	13	340	7.8	13	
17		2	5	0	7	0.2	0.1	606	37.0	7	338	6.9	7	
18		1	3	0	4	0.1	0.1	618	50.6	4	344	11.0	4	
All Samples Combined		1,879	1,894	0	3,773	100.0		386	103.4	3,773	294	24.3	3,773	
Sex Composition		49.8	50.2											
Unaged		220	238	0	458	12.1		405	103.2	457	300	23.6	458	
Sex Composition		48.0	52.0											

-continued-

Appendix B5.—Age, sex and size composition of Pacific herring caught by commercial gillnet, Kulukak Section, 13 May–17 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
13-May	6	1	0	0	1	0.9	0.9	355		1	283		1	
	7	2	1	0	3	2.8	1.6	367	47.7	3	287	7.2	3	
	8	13	23	0	36	33.0	4.5	394	32.0	36	297	6.3	36	
	9	27	22	0	49	45.0	4.8	403	37.5	48	302	6.6	49	
	10	8	5	0	13	11.9	3.1	454	26.0	13	313	5.3	13	
	11	1	0	0	1	0.9	0.9	516		1	329		1	
	12	3	1	0	4	3.7	1.8	520	27.8	4	326	4.5	4	
	13													
	14	0	1	0	1	0.9	0.9	532		1	331		1	
15	1	0	0	1	0.9	0.9	470		1	330		1		
Sample Total		56	53	0	109	100.0		412	47.4	108	302	10.7	109	
14-May	7	1	1	0	2	2.2	1.5	382	7.1	2	294	3.5	2	
	8	11	17	0	28	30.4	4.8	379	29.2	28	294	4.5	28	
	9	25	11	0	36	39.1	5.1	418	40.0	36	304	8.0	36	
	10	9	11	0	20	21.7	4.3	458	41.5	20	316	5.5	20	
	11	2	0	0	2	2.2	1.5	515	7.8	2	327	1.4	2	
	12	3	0	0	3	3.3	1.9	504	44.4	3	323	6.2	3	
	13	0	1	0	1	1.1	1.1	519		1	336		1	
Sample Total		51	41	0	92	100.0		420	51.7	92	305	11.7	92	
15-May	7	1	1	0	2	1.9	1.3	363	10.6	2	286	1.4	2	
	8	12	19	0	31	29.8	4.5	378	31.7	31	295	5.8	31	
	9	21	16	0	37	35.6	4.7	415	31.1	37	304	6.9	37	
	10	16	12	0	28	26.9	4.4	450	33.0	28	314	5.6	28	
	11	2	0	0	2	1.9	1.3	520	3.5	2	326	7.8	2	
	12	2	0	0	2	1.9	1.3	502	2.1	2	325	1.4	2	
	13													
	14													
	15	0	1	0	1	1.0	1.0	576		1	337		1	
16	1	0	0	1	1.0	1.0	642		1	338		1		
Sample Total		55	49	0	104	100.0		420	52.9	104	305	11.5	104	
16-May	7	1	0	0	1	1.0	1.0	363		1	298		1	
	8	12	16	0	28	26.7	4.3	387	28.7	28	296	6.3	28	
	9	25	24	0	49	46.7	4.9	415	30.5	49	304	5.8	49	
	10	8	11	0	19	18.1	3.8	449	36.7	19	312	6.2	19	
	11	0	3	0	3	2.9	1.6	497	8.2	3	325	6.7	3	
	12	1	0	0	1	1.0	1.0	471		1	325		1	
	13	2	0	0	2	1.9	1.3	480	7.1	2	324	5.7	2	
	14	0	1	0	1	1.0	1.0	502		1	326		1	
	15													
16	0	1	0	1	1.0	1.0	554		1	352		1		
Sample Total		49	56	0	105	100.0		419	43.2	105	305	10.6	105	

-continued-

Appendix B5.–Page 2 of 2.

Sample Dates	Age	Sex (number)			Total	Percent of		Weight		Length				
		Male	Female	Unk.		Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
17-May	4	5	3	0	8	7.2	2.5	212	33.6	8	249	9.5	8	
	5	9	8	0	17	15.3	3.4	237	27.5	17	258	9.5	17	
	6	3	1	0	4	3.6	1.8	263	31.2	4	268	8.0	4	
	7	5	3	0	8	7.2	2.5	322	38.8	8	283	9.1	8	
	8	19	17	0	36	32.4	4.5	379	35.9	36	295	6.4	36	
	9	11	11	0	22	19.8	3.8	414	42.1	22	302	6.7	22	
	10	4	4	0	8	7.2	2.5	464	73.1	8	315	10.4	8	
	11	0	1	0	1	0.9	0.9	547		1	324		1	
	12	2	3	0	5	4.5	2.0	483	52.9	5	323	8.0	5	
	13	0	1	0	1	0.9	0.9	415		1	337		1	
	14	0	1	0	1	0.9	0.9	615		1	331		1	
	Sample Total		58	53	0	111	100.0		359	94.8	111	289	23.0	111
	13–17 May	4	5	3	0	8	1.5	0.5	212	33.6	8	249	9.5	8
		5	9	8	0	17	3.3	0.8	237	27.5	17	258	9.5	17
6		4	1	0	5	1.0	0.4	281	49.4	5	271	9.7	5	
7		10	6	0	16	3.1	0.8	346	40.3	16	287	8.2	16	
8		67	92	0	159	30.5	2.0	384	32.1	159	295	6.0	159	
9		109	84	0	193	37.0	2.1	413	35.8	192	303	6.8	193	
10		45	43	0	88	16.9	1.6	453	39.2	88	314	6.2	88	
11		5	4	0	9	1.7	0.6	514	16.7	9	326	4.6	9	
12		11	4	0	15	2.9	0.7	499	39.0	15	324	5.5	15	
13		2	2	0	4	0.8	0.4	474	43.3	4	330	7.9	4	
14		0	3	0	3	0.6	0.3	550	58.5	3	329	2.9	3	
15	1	1	0	2	0.4	0.3	523	75.0	2	334	4.9	2		
16	1	1	0	2	0.4	0.3	598	62.2	2	345	9.9	2		
All Samples Combined		269	252	0	521	100.0		405	66.0	520	301	15.7	521	
Sex Composition		51.6	48.4											
Unaged		41	48	0	89	17.1		433	70.8	89	308	18.9	89	
Sex Composition		46.1	53.9											

Appendix B6.—Age, sex and size composition of Pacific herring caught by commercial gillnet, Nunavachak Section, 14 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
14-May	7	3	2	0	5	3.6	1.6	356	57.9	5	287	14.1	5	
	8	17	26	0	43	31.2	4.0	381	36.6	43	294	7.4	43	
	9	25	36	0	61	44.2	4.2	417	30.0	61	305	5.8	61	
	10	5	15	0	20	14.5	3.0	467	34.8	20	316	5.8	20	
	11	1	0	0	1	0.7	0.7	447		1	304		1	
	12	2	4	0	6	4.3	1.7	531	33.0	6	328	9.1	6	
	13	0	1	0	1	0.7	0.7	597		1	345		1	
	14													
	15													
	16	1	0	0	1	0.7	0.7	585		1	337		1	
All Samples Combined		54	84	0	138	100.0		419	55.0	138	304	12.5	138	
Sex Composition		39.1	60.9											
Unaged		8	9	0	17	12.3		433	69.0	17	310	16.9	17	
Sex Composition		47.1	52.9											

Appendix B7.—Age, sex and size composition of Pacific herring caught by commercial gillnet, Kulukak and Nunavachak Sections, 13 May–17 May 2006.

Sample Dates	Age	Sex (number)			Total	Percent of Total	Weight			Length				
		Male	Female	Unk.			Mean SE	SD	Number Weighed	Mean (mm)	SD	Number Measured		
13-May	6	1	0	0	1	0.9	0.9	355		1	283		1	
	7	2	1	0	3	2.8	1.6	367	47.7	3	287	7.2	3	
	8	13	23	0	36	33.0	4.5	394	32.0	36	297	6.3	36	
	9	27	22	0	49	45.0	4.8	403	37.5	48	302	6.6	49	
	10	8	5	0	13	11.9	3.1	454	26.0	13	313	5.3	13	
	11	1	0	0	1	0.9	0.9	516		1	329		1	
	12	3	1	0	4	3.7	1.8	520	27.8	4	326	4.5	4	
	13													
	14	0	1	0	1	0.9	0.9	532		1	331		1	
	15	1	0	0	1	0.9	0.9	470		1	330		1	
Sample Total		56	53	0	109	100.0		412	47.4	108	302	10.7	109	
14-May	7	4	3	0	7	3.0	1.1	363	49.1	7	289	12.0	7	
	8	28	43	0	71	30.9	3.1	380	33.7	71	294	6.4	71	
	9	50	47	0	97	42.2	3.3	418	33.8	97	305	6.7	97	
	10	14	26	0	40	17.4	2.5	462	38.1	40	316	5.6	40	
	11	3	0	0	3	1.3	0.7	492	39.4	3	319	13.3	3	
	12	5	4	0	9	3.9	1.3	522	36.9	9	326	8.2	9	
	13	0	2	0	2	0.9	0.6	558	55.2	2	341	6.4	2	
	14													
	15													
	16	1	0	0	1	0.4	0.4	585		1	337		1	
Sample Total		105	125	0	230	100.0		419	53.6	230	304	12.1	230	
15-May	7	1	1	0	2	1.9	1.3	363	10.6	2	286	1.4	2	
	8	12	19	0	31	29.8	4.5	378	31.7	31	295	5.8	31	
	9	21	16	0	37	35.6	4.7	415	31.1	37	304	6.9	37	
	10	16	12	0	28	26.9	4.4	450	33.0	28	314	5.6	28	
	11	2	0	0	2	1.9	1.3	520	3.5	2	326	7.8	2	
	12	2	0	0	2	1.9	1.3	502	2.1	2	325	1.4	2	
	13													
	14													
	15	0	1	0	1	1.0	1.0	576		1	337		1	
	16	1	0	0	1	1.0	1.0	642		1	338		1	
Sample Total		55	49	0	104	100.0		420	52.9	104	305	11.5	104	
16-May	7	1	0	0	1	1.0	1.0	363		1	298		1	
	8	12	16	0	28	26.7	4.3	387	28.7	28	296	6.3	28	
	9	25	24	0	49	46.7	4.9	415	30.5	49	304	5.8	49	
	10	8	11	0	19	18.1	3.8	449	36.7	19	312	6.2	19	
	11	0	3	0	3	2.9	1.6	497	8.2	3	325	6.7	3	
	12	1	0	0	1	1.0	1.0	471		1	325		1	
	13	2	0	0	2	1.9	1.3	480	7.1	2	324	5.7	2	
	14	0	1	0	1	1.0	1.0	502		1	326		1	
	15													
	16	0	1	0	1	1.0	1.0	554		1	352		1	
Sample Total		49	56	0	105	100.0		419	43.2	105	305	10.6	105	

-continued-

Appendix B7.–Page 2 of 2.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length		
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
17-May	4	5	3	0	8	7.2	2.5	212	33.6	8	249	9.5	8
	5	9	8	0	17	15.3	3.4	237	27.5	17	258	9.5	17
	6	3	1	0	4	3.6	1.8	263	31.2	4	268	8.0	4
	7	5	3	0	8	7.2	2.5	322	38.8	8	283	9.1	8
	8	19	17	0	36	32.4	4.5	379	35.9	36	295	6.4	36
	9	11	11	0	22	19.8	3.8	414	42.1	22	302	6.7	22
	10	4	4	0	8	7.2	2.5	464	73.1	8	315	10.4	8
	11	0	1	0	1	0.9	0.9	547		1	324		1
	12	2	3	0	5	4.5	2.0	483	52.9	5	323	8.0	5
	13	0	1	0	1	0.9	0.9	415		1	337		1
14	0	1	0	1	0.9	0.9	615		1	331		1	
Sample Total		58	53	0	111	100.0		359	94.8	111	289	23.0	111
13–17 May	4	5	3	0	8	1.2	0.4	212	33.6	8	249	9.5	8
	5	9	8	0	17	2.6	0.6	237	27.5	17	258	9.5	17
	6	4	1	0	5	0.8	0.3	281	49.4	5	271	9.7	5
	7	13	8	0	21	3.2	0.7	348	43.7	21	287	9.5	21
	8	84	118	0	202	30.7	1.8	383	33.0	202	295	6.3	202
	9	134	120	0	254	38.5	1.9	414	34.5	253	304	6.6	254
	10	50	58	0	108	16.4	1.4	456	38.6	108	314	6.2	108
	11	6	4	0	10	1.5	0.5	507	26.3	10	324	8.2	10
	12	13	8	0	21	3.2	0.7	508	39.6	21	325	6.7	21
	13	2	3	0	5	0.8	0.3	498	66.8	5	333	9.5	5
14	0	3	0	3	0.5	0.3	550	58.5	3	329	2.9	3	
15	1	1	0	2	0.3	0.2	523	75.0	2	334	4.9	2	
16	2	1	0	3	0.5	0.3	594	44.6	3	342	8.4	3	
All Samples Combined		323	336	0	659	100.0		408	64.1	658	302	15.1	659
Sex Composition		49.0	51.0										
Unaged		49	57	0	106	16.1		433	70.2	106	309	18.5	106
Sex Composition		46.2	53.8										

Appendix B8.—Age, sex and size composition of Pacific herring caught by test purse seine, Hagemeister Section, 10 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
10-May	4	5	4	0	9	6.0	1.9	171	27.2	9	236	9.2	9	
	5	9	9	0	18	12.0	2.7	243	36.7	18	256	12.6	18	
	6	2	2	0	4	2.7	1.3	310	33.2	4	276	6.8	4	
	7	0	2	0	2	1.3	0.9	353	25.5	2	286	8.5	2	
	8	14	10	0	24	16.0	3.0	385	43.8	24	293	6.7	24	
	9	27	25	0	52	34.7	3.9	418	49.4	52	301	8.9	52	
	10	9	6	0	15	10.0	2.5	490	48.6	15	317	8.1	15	
	11	4	4	0	8	5.3	1.8	493	57.8	8	317	8.6	8	
	12	3	4	0	7	4.7	1.7	540	69.1	7	322	7.6	7	
	13	0	1	0	1	0.7	0.7	638		1	335		1	
	14	1	1	0	2	1.3	0.9	493	26.2	2	321	6.4	2	
	15	3	0	0	3	2.0	1.1	522	34.6	3	326	1.2	3	
	16	1	1	0	2	1.3	0.9	547	101.8	2	335	6.4	2	
	17	1	2	0	3	2.0	1.1	562	87.0	3	330	4.4	3	
	All Samples Combined		79	71	0	150	100.0		399	111.7	150	295	26.1	150
	Sex Composition		52.7	47.3										
	Unaged		3	7	0	10	6.7		448	120.7	10	305	21.0	10
Sex Composition		30.0	70.0											

Appendix B9.—Age, sex and size composition of Pacific herring caught by test purse seine, Kulukak Section, 11 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
11-May	4	6	6	0	12	8.7	2.4	198	44.8	12	240	12.8	12	
	5	22	21	0	43	31.2	4.0	241	35.1	43	258	9.6	43	
	6	3	10	0	13	9.4	2.5	294	37.6	13	272	6.2	13	
	7	2	2	0	4	2.9	1.4	350	34.5	4	289	4.9	4	
	8	12	10	0	22	15.9	3.1	386	51.8	22	296	8.8	22	
	9	12	16	0	28	20.3	3.4	420	43.5	28	303	8.5	28	
	10	1	4	0	5	3.6	1.6	500	44.9	5	319	6.6	5	
	11	0	1	0	1	0.7	0.7	511		1	316		1	
	12	1	3	0	4	2.9	1.4	565	66.3	4	328	7.4	4	
	13	3	2	0	5	3.6	1.6	543	41.7	5	327	5.3	5	
	14													
	15	0	1	0	1	0.7	0.7	505		1	345		1	
	All Samples Combined		62	76	0	138	100.0		338	112.7	138	281	27.6	138
	Sex Composition		44.9	55.1										
	Unaged		4	8	0	12	8.7		319	105.6	12	278	24.1	12
Sex Composition		33.3	66.7											

Appendix B10.—Age, sex and size composition of Pacific herring caught by test purse seine, Nunavachak Section, 9 May–10 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
9-May	4	0	1	0	1	1.0	1.0	204		1	240		1	
	5	2	4	0	6	5.8	2.3	267	26.3	6	261	3.3	6	
	6	1	0	0	1	1.0	1.0	305		1	275		1	
	7						0.0							
	8	10	12	0	22	21.4	4.1	389	52.3	22	294	7.7	22	
	9	10	18	0	28	27.2	4.4	432	57.4	28	302	11.1	28	
	10	9	16	0	25	24.3	4.2	485	44.8	25	315	5.8	25	
	11	2	4	0	6	5.8	2.3	508	30.2	6	320	2.2	6	
	12	3	2	0	5	4.9	2.1	530	77.8	5	322	12.8	5	
	13	1	1	0	2	1.9	1.4	556	5.7	2	327	0.7	2	
	14	0	3	0	3	2.9	1.7	580	49.7	3	333	6.4	3	
	15	1	2	0	3	2.9	1.7	527	44.4	3	327	5.5	3	
	16													
	17	1	0	0	1	1.0	1.0	560		1	327		1	
	Sample Total		40	63	0	103	100.0		443	88.0	103	305	18.8	103
	10-May	4	0	1	0	1	0.7	0.7	195		1	239		1
		5	6	5	0	11	7.9	2.3	259	29.1	11	261	4.8	11
6		2	9	0	11	7.9	2.3	283	26.1	11	272	5.6	11	
7		5	4	0	9	6.5	2.1	312	41.7	9	278	9.1	9	
8		24	27	0	51	36.7	4.1	377	33.1	51	292	6.2	51	
9		12	30	0	42	30.2	3.9	414	41.8	42	300	8.7	42	
10		3	10	0	13	9.4	2.5	475	49.6	13	312	4.2	13	
11	0	1	0	1	0.7	0.7	559		1	318		1		
Sample Total		52	87	0	139	100.0		376	72.4	139	291	15.8	139	
9–10 May	4	0	2	0	2	0.8	0.6	200	6.4	2	240	0.7	2	
	5	8	9	0	17	7.0	1.6	261	27.6	17	261	4.2	17	
	6	3	9	0	12	5.0	1.4	284	25.7	12	272	5.4	12	
	7	5	4	0	9	3.7	1.2	312	41.7	9	278	9.1	9	
	8	34	39	0	73	30.2	3.0	380	39.9	73	293	6.7	73	
	9	22	48	0	70	28.9	2.9	421	49.1	70	301	9.8	70	
	10	12	26	0	38	15.7	2.3	482	46.1	38	314	5.4	38	
	11	2	5	0	7	2.9	1.1	515	33.7	7	320	2.1	7	
	12	3	2	0	5	2.1	0.9	530	77.8	5	322	12.8	5	
	13	1	1	0	2	0.8	0.6	556	5.7	2	327	0.7	2	
	14	0	3	0	3	1.2	0.7	580	49.7	3	333	6.4	3	
15	1	2	0	3	1.2	0.7	527	44.4	3	327	5.5	3		
16														
17	1	0	0	1	0.4	0.4	560		1	327		1		
All Samples Combined		92	150	0	242	100.0		404	85.8	242	297	18.4	242	
Sex Composition		38.0	62.0											
Unaged		5	15	0	20	8.3		390	73.3	20	293	16.6	20	
Sex Composition		25.0	75.0											

Appendix B11.—Age, sex and size composition of Pacific herring caught by test purse seine, Togiak Section, 11 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length		
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
	3	0	1	0	1	0.7	0.7	166		1	236		1
	4	38	26	0	64	43.5	4.1	174	36.9	64	234	12.6	64
	5	23	18	0	41	27.9	3.7	233	30.4	41	254	9.3	41
	6	5	6	0	11	7.5	2.2	279	23.6	11	268	6.9	11
11-May	7	2	2	0	4	2.7	1.3	343	38.9	4	285	7.8	4
	8	4	13	0	17	11.6	2.7	389	30.5	17	294	6.5	17
	9	1	5	0	6	4.1	1.6	395	42.5	6	295	7.8	6
	10												
	11	0	3	0	3	2.0	1.2	493	95.7	3	327	4.9	3
All Samples Combined		73	74	0	147	100.0		243	91.9	147	255	26.1	147
Sex Composition		49.7	50.3										
Unaged		2	1	0	3	2.0		198	39.5	3	247	9.8	3
Sex Composition		66.7	33.3										

Appendix B12.—Age, sex and size composition of Pacific herring caught by test purse seine, Hagemeister, Kulukak, Nunavachak, and Togiak Sections, 9 May–11 May 2006.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length			
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
9-May	4	0	1	0	1	1.0	1.0	204		1	240		1	
	5	2	4	0	6	5.8	2.3	267	26.3	6	261	3.3	6	
	6	1	0	0	1	1.0	1.0	305		1	275		1	
	7													
	8	10	12	0	22	21.4	4.1	389	52.3	22	294	7.7	22	
	9	10	18	0	28	27.2	4.4	432	57.4	28	302	11.1	28	
	10	9	16	0	25	24.3	4.2	485	44.8	25	315	5.8	25	
	11	2	4	0	6	5.8	2.3	508	30.2	6	320	2.2	6	
	12	3	2	0	5	4.9	2.1	530	77.8	5	322	12.8	5	
	13	1	1	0	2	1.9	1.4	556	5.7	2	327	0.7	2	
	14	0	3	0	3	2.9	1.7	580	49.7	3	333	6.4	3	
	15	1	2	0	3	2.9	1.7	527	44.4	3	327	5.5	3	
	16													
	17	1	0	0	1	1.0	1.0	560		1	327		1	
	Sample Total		40	63	0	103	100.0		443	88.0	103	305	18.8	103
	10-May	4	5	5	0	10	3.5	1.1	174	26.7	10	236	8.7	10
		5	15	14	0	29	10.0	1.8	249	34.4	29	258	10.5	29
6		4	11	0	15	5.2	1.3	290	29.6	15	273	5.9	15	
7		5	6	0	11	3.8	1.1	319	41.6	11	279	9.2	11	
8		38	37	0	75	26.0	2.6	379	36.7	75	292	6.3	75	
9		39	55	0	94	32.5	2.8	416	46.0	94	300	8.8	94	
10		12	16	0	28	9.7	1.7	483	48.7	28	315	7.0	28	
11		4	5	0	9	3.1	1.0	500	58.4	9	317	8.0	9	
12		3	4	0	7	2.4	0.9	540	69.1	7	322	7.6	7	
13		0	1	0	1	0.3	0.3	638		1	335		1	
14		1	1	0	2	0.7	0.5	493	26.2	2	321	6.4	2	
15		3	0	0	3	1.0	0.6	522	34.6	3	326	1.2	3	
16		1	1	0	2	0.7	0.5	547	101.8	2	335	6.4	2	
17		1	2	0	3	1.0	0.6	562	87.0	3	330	4.4	3	
Sample Total		131	158	0	289	100.0		388	95.4	289	293	21.8	289	
11-May		3	0	1	0	1	0.4	0.4	166		1	236		1
		4	44	32	0	76	26.7	2.6	178	38.9	76	235	12.7	76
	5	45	39	0	84	29.5	2.7	237	33.0	84	256	9.6	84	
	6	8	16	0	24	8.4	1.6	287	32.2	24	270	6.7	24	
	7	4	4	0	8	2.8	1.0	346	34.3	8	287	6.4	8	
	8	16	23	0	39	13.7	2.0	388	43.4	39	295	7.8	39	
	9	13	21	0	34	11.9	1.9	415	43.7	34	301	8.8	34	
	10	1	4	0	5	1.8	0.8	500	44.9	5	319	6.6	5	
	11	0	4	0	4	1.4	0.7	497	78.7	4	325	7.0	4	
	12	1	3	0	4	1.4	0.7	565	66.3	4	328	7.4	4	
	13	3	2	0	5	1.8	0.8	543	41.7	5	327	5.3	5	
	14													
	15	0	1	0	1	0.4	0.4	505		1	345		1	
	Sample Total		135	150	0	285	100.0		289	112.9	285	268	29.8	285

-continued-

Appendix B12.–Page 2 of 2.

Sample Dates	Age	Sex (number)				Percent of		Weight			Length		
		Male	Female	Unk.	Total	Total	SE	Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured
	3	0	1	0	1	0.1	0.1	166		1	236		1
	4	49	38	0	87	12.9	1.3	178	37.5	87	235	12.2	87
	5	62	57	0	119	17.6	1.5	241	33.7	119	257	9.7	119
	6	13	27	0	40	5.9	0.9	288	30.6	40	271	6.5	40
	7	9	10	0	19	2.8	0.6	331	40.1	19	282	8.9	19
	8	64	72	0	136	20.1	1.5	383	41.4	136	293	7.0	136
	9	62	94	0	156	23.0	1.6	419	47.8	156	301	9.2	156
	10	22	36	0	58	8.6	1.1	486	46.2	58	315	6.5	58
9–11 May	11	6	13	0	19	2.8	0.6	502	53.1	19	319	6.9	19
	12	7	9	0	16	2.4	0.6	543	67.8	16	323	9.2	16
	13	4	4	0	8	1.2	0.4	558	45.6	8	328	4.9	8
	14	1	4	0	5	0.7	0.3	545	60.7	5	328	9.0	5
	15	4	3	0	7	1.0	0.4	522	33.4	7	329	7.8	7
	16	1	1	0	2	0.3	0.2	547	101.8	2	335	6.4	2
	17	2	2	0	4	0.6	0.3	562	71.0	4	329	3.9	4
All Samples Combined		306	371	0	677	100.0		355	117.7	677	284	29.0	677
Sex Composition		45.2	54.8										
Unaged		14	31	0	45	6.6		371	111.6	45	289	23.9	45
Sex Composition		31.1	68.9										

Appendix B13.—Age, sex and size composition of Pacific herring caught by test fishing and purse seine, Hagemester, Kulukak, Nunavachak, and Togiak Sections, 9 May–15 May 2006.

Sample Dates	Age	Sex (number)				Percent			Weight		Length			
		Male	Female	Unk.	Total	Total	SE	Mean	Number	Mean	Number	SD	Measured	
								(g)		(mm)				
9-May	4	0	1	0	1	1.0	1.0	204		1	240		1	
	5	2	4	0	6	5.8	2.3	267	26.3	6	261	3.3	6	
	6	1	0	0	1	1.0	1.0	305		1	275		1	
	7			0										
	8	10	12	0	22	21.4	4.1	389	52.3	22	294	7.7	22	
	9	10	18	0	28	27.2	4.4	432	57.4	28	302	11.1	28	
	10	9	16	0	25	24.3	4.2	485	44.8	25	315	5.8	25	
	11	2	4	0	6	5.8	2.3	508	30.2	6	320	2.2	6	
	12	3	2	0	5	4.9	2.1	530	77.8	5	322	12.8	5	
	13	1	1	0	2	1.9	1.4	556	5.7	2	327	0.7	2	
	14	0	3	0	3	2.9	1.7	580	49.7	3	333	6.4	3	
	15	1	2	0	3	2.9	1.7	527	44.4	3	327	5.5	3	
	16			0										
	17	1	0	0	1	1.0	1.0	560		1	327		1	
	Sample Total		40	63	0	103	100.0		443	88.0	103	305	18.8	103
	10-May	4	5	5	0	10	3.5	1.1	174	26.7	10	236	8.7	10
		5	15	14	0	29	10.0	1.8	249	34.4	29	258	10.5	29
6		4	11	0	15	5.2	1.3	290	29.6	15	273	5.9	15	
7		5	6	0	11	3.8	1.1	319	41.6	11	279	9.2	11	
8		38	37	0	75	26.0	2.6	379	36.7	75	292	6.3	75	
9		39	55	0	94	32.5	2.8	416	46.0	94	300	8.8	94	
10		12	16	0	28	9.7	1.7	483	48.7	28	315	7.0	28	
11		4	5	0	9	3.1	1.0	500	58.4	9	317	8.0	9	
12		3	4	0	7	2.4	0.9	540	69.1	7	322	7.6	7	
13		0	1	0	1	0.3	0.3	638		1	335		1	
14		1	1	0	2	0.7	0.5	493	26.2	2	321	6.4	2	
15		3	0	0	3	1.0	0.6	522	34.6	3	326	1.2	3	
16		1	1	0	2	0.7	0.5	547	101.8	2	335	6.4	2	
17		1	2	0	3	1.0	0.6	562	87.0	3	330	4.4	3	
Sample Total			131	158	0	289	100.0		388	95.4	289	293	21.8	289
11-May		3	0	1	0	1	0.4	0.4	166		1	236		1
		4	44	32	0	76	26.7	2.6	178	38.9	76	235	12.7	76
	5	45	39	0	84	29.5	2.7	237	33.0	84	256	9.6	84	
	6	8	16	0	24	8.4	1.6	287	32.2	24	270	6.7	24	
	7	4	4	0	8	2.8	1.0	346	34.3	8	287	6.4	8	
	8	16	23	0	39	13.7	2.0	388	43.4	39	295	7.8	39	
	9	13	21	0	34	11.9	1.9	415	43.7	34	301	8.8	34	
	10	1	4	0	5	1.8	0.8	500	44.9	5	319	6.6	5	
	11	0	4	0	4	1.4	0.7	497	78.7	4	325	7.0	4	
	12	1	3	0	4	1.4	0.7	565	66.3	4	328	7.4	4	
	13	3	2	0	5	1.8	0.8	543	41.7	5	327	5.3	5	
	14													
	15	0	1	0	1	0.4	0.4	505		1	345		1	
	Sample Total		135	150	0	285	100.0		289	112.9	285	268	29.8	285

-continued-

Appendix B13.–Page 2 of 3.

Sample Dates	Age	Sex (number)				Percent of Total	SE	Weight		Length				
		Male	Female	Unk.	Total			Mean	SD	Number Weighed	Mean (mm)	SD	Number Measured	
								(g)						
12-May	4	7	6	0	13	1.4	1.2	190	26.1	13	241	7.8	13	
	5	13	20	0	33	3.7	1.9	257	29.3	33	261	7.5	33	
	6	17	9	0	26	2.9	1.7	295	41.1	26	274	8.5	26	
	7	17	9	0	26	2.9	1.7	363	44.3	26	288	7.8	26	
	8	116	99	0	215	23.9	4.2	391	40.5	215	295	7.1	215	
	9	123	123	0	246	27.3	4.4	429	43.5	246	304	7.4	246	
	10	77	92	0	169	18.8	3.9	488	48.0	169	316	7.7	169	
	11	11	23	0	34	3.8	1.9	532	51.3	34	322	8.7	34	
	12	26	39	0	65	7.2	2.6	547	48.5	65	328	6.9	65	
	13	8	15	0	23	2.6	1.6	565	58.9	23	330	8.6	23	
	14	14	10	0	24	2.7	1.6	574	62.9	24	331	8.7	24	
	15	7	5	0	12	1.3	1.1	561	66.9	12	330	12.7	12	
	16	2	6	0	8	0.9	0.9	622	60.6	8	341	9.4	8	
	17	1	2	0	3	0.3	0.5	621	19.7	3	334	5.6	3	
	18	1	2	0	3	0.3	0.5	618	62.0	3	340	9.6	3	
	Sample Total		440	460	0	900	100.0		440	93.2	900	305	19.6	900
	13-May	4	6	4	0	10	1.4	0.7	197	23.6	10	244	7.6	10
		5	24	18	0	42	6.0	1.4	248	30.1	42	259	7.3	42
6		6	9	0	15	2.1	0.8	299	26.8	15	272	5.8	15	
7		18	12	0	30	4.3	1.2	339	33.4	30	283	6.6	30	
8		97	77	0	174	24.8	2.5	388	38.2	174	295	6.1	174	
9		104	117	0	221	31.5	2.7	423	43.3	221	304	6.0	221	
10		56	75	0	131	18.7	2.3	476	42.9	131	316	5.9	131	
11		9	3	0	12	1.7	0.8	489	40.3	12	323	5.7	12	
12		18	22	0	40	5.7	1.4	544	46.2	40	327	8.2	40	
13		2	4	0	6	0.9	0.6	576	39.2	6	331	11.3	6	
14		5	6	0	11	1.6	0.7	567	42.6	11	333	4.8	11	
15		2	3	0	5	0.7	0.5	559	38.6	5	338	4.5	5	
16		0	1	0	1	0.1	0.2	562		1	345		1	
17		1	1	0	2	0.3	0.3	576	62.9	2	337	1.4	2	
18		0	1	0	1	0.1	0.2	620		1	355		1	
Sample Total		348	353	0	701	100.0		418	85.7	701	302	19.3	701	
14-May		4	6	8	0	14	2.1	0.9	199	28.1	14	241	11.2	14
		5	24	54	0	78	11.9	1.9	243	24.7	78	258	8.7	78
	6	23	17	0	40	6.1	1.4	279	37.3	40	269	9.5	40	
	7	30	16	0	46	7.0	1.5	349	40.4	46	287	7.7	46	
	8	97	81	0	178	27.1	2.6	374	36.1	178	294	6.5	178	
	9	70	93	0	163	24.8	2.6	413	41.7	163	303	6.7	163	
	10	42	52	0	94	14.3	2.1	460	40.0	94	314	5.1	94	
	11	4	5	0	9	1.4	0.7	477	69.1	9	320	6.7	9	
	12	14	8	0	22	3.3	1.1	521	45.5	22	325	5.3	22	
	13	1	1	0	2	0.3	0.3	593	46.0	2	337	4.9	2	
	14	4	2	0	6	0.9	0.6	523	55.8	6	331	4.9	6	
	15	1	3	0	4	0.6	0.5	525	80.7	4	332	10.8	4	
	16	0	2	0	2	0.3	0.3	543	55.2	2	338	5.7	2	
	Sample Total		316	342	0	658	100.0		379	87.3	658	294	21.4	658

-continued-

Appendix B13.–Page 3 of 3.

Sample Dates	Age	Sex (number)				Percent of Total	SE	Weight		Length				
		Male	Female	Unk.	Total			Mean (g)	SD	Number Weighed	Mean (mm)	SD	Number Measured	
15-May	3	0	1	0	1	0.2	0.4	221		1	249		1	
	4	19	11	0	30	5.2	2.2	189	23.4	30	241	9.4	30	
	5	37	38	0	75	13.1	3.3	248	43.9	75	261	10.9	75	
	6	17	15	0	32	5.6	2.3	278	37.7	32	270	6.8	32	
	7	21	19	0	40	7.0	2.5	333	31.7	40	285	5.7	40	
	8	71	62	0	133	23.3	4.2	370	39.3	133	294	7.4	133	
	9	69	75	0	144	25.2	4.3	405	35.5	144	303	5.3	144	
	10	28	46	0	74	12.9	3.3	467	45.2	74	316	5.7	74	
	11	3	5	0	8	1.4	1.2	493	55.6	8	318	3.9	8	
	12	12	11	0	23	4.0	1.9	544	69.3	23	328	8.4	23	
	13	2	3	0	5	0.9	0.9	499	43.4	5	329	8.7	5	
	14	0	2	0	2	0.3	0.5	557	60.8	2	333	2.1	2	
	15	1	2	0	3	0.5	0.7	525	66.5	3	327	7.5	3	
	16			0										
	17	0	2	0	2	0.3	0.5	615	27.6	2	344	9.9	2	
	18													
	Sample Total		280	292	0	572	100.0		370	97.3	572	293	23.5	572
09–15 May	3	0	2	0	2	0.1	0.1	194	38.9	2	243	9.2	2	
	4	87	67	0	154	4.4	0.3	184	33.3	154	238	11.3	154	
	5	160	187	0	347	9.9	0.5	245	33.8	347	259	9.4	347	
	6	76	77	0	153	4.4	0.3	286	35.9	153	271	7.8	153	
	7	95	66	0	161	4.6	0.4	344	38.9	161	286	7.4	161	
	8	445	391	0	836	23.8	0.7	382	39.9	836	294	6.8	836	
	9	428	502	0	930	26.5	0.7	419	43.5	930	303	7.1	930	
	10	225	301	0	526	15.0	0.6	477	45.8	526	316	6.5	526	
	11	33	49	0	82	2.3	0.3	509	55.6	82	321	7.4	82	
	12	77	89	0	166	4.7	0.4	542	53.0	166	327	7.6	166	
	13	17	27	0	44	1.3	0.2	559	55.3	44	330	8.2	44	
	14	24	24	0	48	1.4	0.2	562	57.9	48	331	7.3	48	
	15	15	16	0	31	0.9	0.2	543	57.9	31	331	10.0	31	
	16	3	10	0	13	0.4	0.1	594	68.2	13	340	8.1	13	
	17	4	7	0	11	0.3	0.1	590	53.3	11	335	7.1	11	
	18	1	3	0	4	0.1	0.1	618	50.6	4	344	11.0	4	
	All Samples Combined		1,690	1,818	0	3,508	100.0		396	102.0	3,508	296	23.8	3,508
Sex Composition		48.2	51.8											
Unaged		174	211	0	385	11.0		419	97.2	384	302	21.7	385	
Sex Composition		45.2	54.8											

APPENDIX C



**ALASKA DEPARTMENT OF
FISH & GAME
DIVISION OF COMMERCIAL FISHERIES
NEWS RELEASE**

2006 Togiak Herring Forecast

ISSUED: November 23, 2005

The 2006 Togiak herring forecast and harvest allocation is listed below for the Togiak District sac roe fishery and the Dutch Harbor food and bait fishery, given a maximum 20% exploitation rate of the projected run biomass:

*Harvest Allocation of the 2006 Forecasted Pacific
Herring Run Biomass, Togiak District, Bristol Bay*

	Biomass (Short Tons)	Harvest (Short Tons)
Forecasted Biomass for 2006	129,976	
Exploitation @ maximum 20% for Total Allowable Harvest		25,995
Togiak Spawn-on-Kelp Fishery (Fixed Allocation)		1,500
Remaining Allowable Harvest		24,495
Dutch Harbor Food/Bait Allocation (7.0% of the remaining allocation)		1,715
Remaining Allowable Harvest for Togiak District Sac Roe Fishery:		22,780
Purse Seine Allocation 70.0%		15,946
Gill Net Allocation 30.0%		6,834

-continued-

2006 TOGIAC HERRING FORECAST SUMMARY

The Pacific herring population is forecast to be 129,976 tons in the Togiak District during 2006 (Figure 1). Herring returning from the 1996, 1997 and 1998-year classes (Age-10, -9 and -8, respectively) are expected to comprise 83% of the biomass. Age-9 herring are expected to make up 46% of the biomass followed by age-10 (22%) and age-8 (15%; Figure 2). The remainder of the herring population is expected to be comprised of age 4–7 (5%) and age 11–15 (12%) fish. The forecasted individual average weight of herring in the harvest biomass is 347 g.

We used an age-structured analysis (ASA) model to forecast the Togiak herring population using catch and age composition data and aerial survey biomass estimates. The ASA model integrated data from purse seine fishery age compositions (1978–2005), total run age compositions (1978–1995, 1997, 1999, 2001, and 2005), and aerial survey biomass estimates (1981, 1983, 1992–1994, 1997, 1999–2001, and 2005). Model estimates were generated and compared to observed data. Samples from non-selective gear (commercial purse seine and test purse seine) were used to assess the age composition of the total run biomass. Commercial purse seine catch and test fish samples ranged from age-4 to age-18. Simple linear regression models were used to forecast the weight of each age class based on their weights the previous year.

A temporal change in age composition from older to younger herring typically occurs in the fishery. However, age-7, -8, and -9 herring predominated throughout 2005. This may signify that younger age classes (age 4–6) of herring are weak or that these age classes did not arrive during the commercial fishery. However, assessing younger age classes of herring is difficult. Younger herring typically do not show up until the later part of the fishery. In addition, we no longer conduct post-fishery sampling that occurred during the 1980's.

The Togiak District herring biomass was estimated to be 156,757 tons in 2005. This was the sum of the peak biomass aerial survey estimate of 108,585 (tons) observed May 1, the aerial biomass estimate of 45,709 (tons) observed May 16, and the estimate of 2,433 (tons) observed May 26. Herring were first reported in the district on April 28, when approximately 11,814 tons were documented. The peak biomass was observed on May 1 with a majority of the estimated 108,585 tons concentrated in Hagemeister and Togiak sections. Biomass of the Togiak herring spawning population has been estimated with aerial surveys since the late 1970's, concurrent with the development of the sac-roe fishery. Large recruitment events have been observed approximately every eight to ten years in the Togiak herring population with the most recent events occurring from the 1996 and 1997-year classes.

There is always uncertainty in forecasting the Togiak District herring biomass and predicting the 2006 return is no different than previous years. Since its inception in 1993, the performance of the ASA model has had a tendency to be biased low. The mean percent error (MPE) was –27% for years with reliable total run biomass estimates (Figure 1). The accuracy or mean absolute percent error (MAPE) of the ASA model has been 25%. We are currently looking into why the forecasts from the ASA model have a tendency to be biased low. In addition, we will continue to work on improving our ability to forecast the Togiak herring population. We consider the Togiak herring population to be healthy and sustainable.

Chuck Brazil, Fred West, and Tim Baker
Bristol Bay Research Staff
Anchorage

-continued-

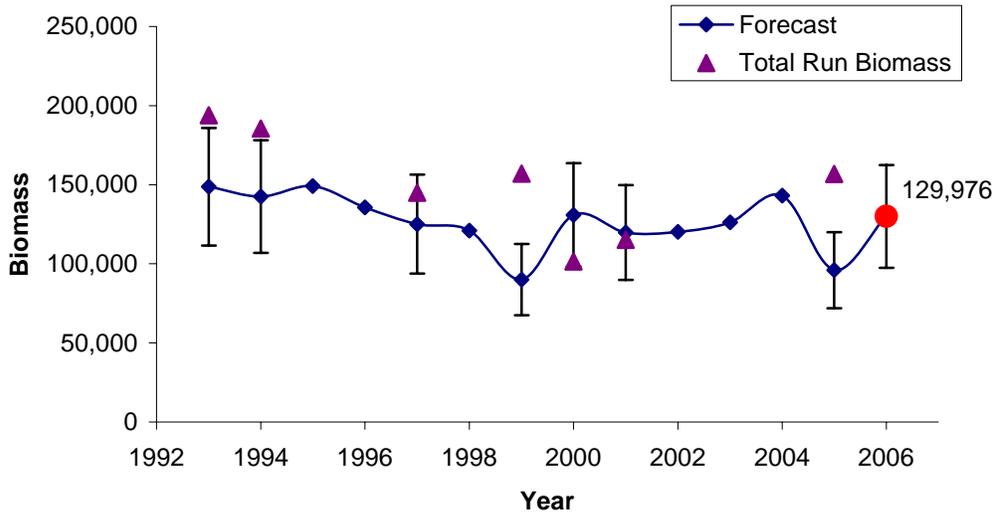


Figure 1. Observed Togiak herring total run biomass estimates and previous preseason forecasts based on the ASA model. Mean absolute percent error (MAPE) of 25% around the forecast is also shown for years with a reliable total run biomass estimate.

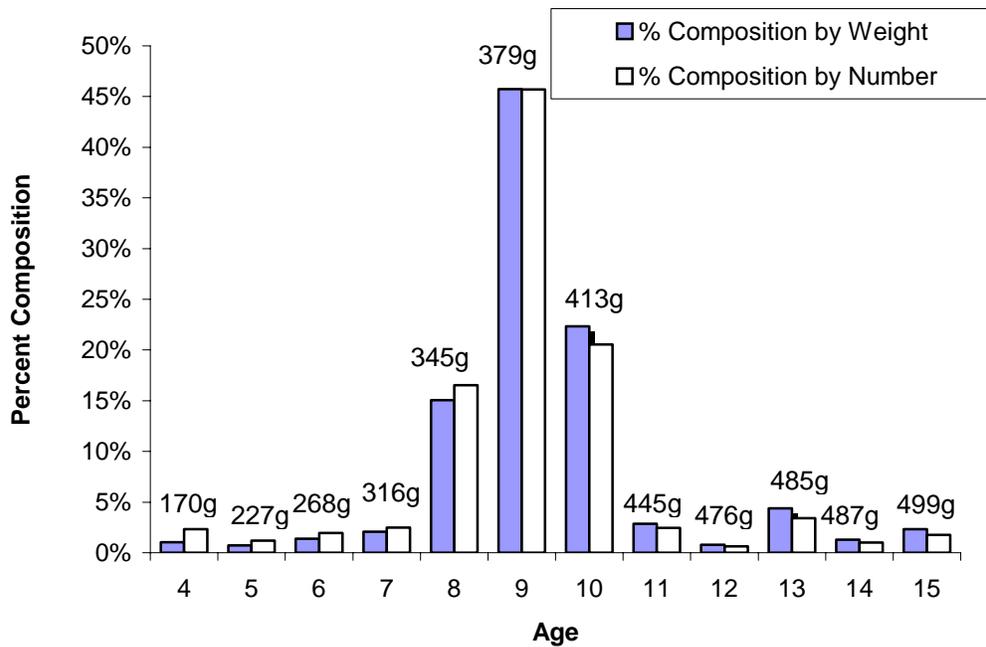


Figure 2. Forecasted age composition by weight and number for the 2006 Togiak herring return. Forecasted average weight (grams) by age is also presented.